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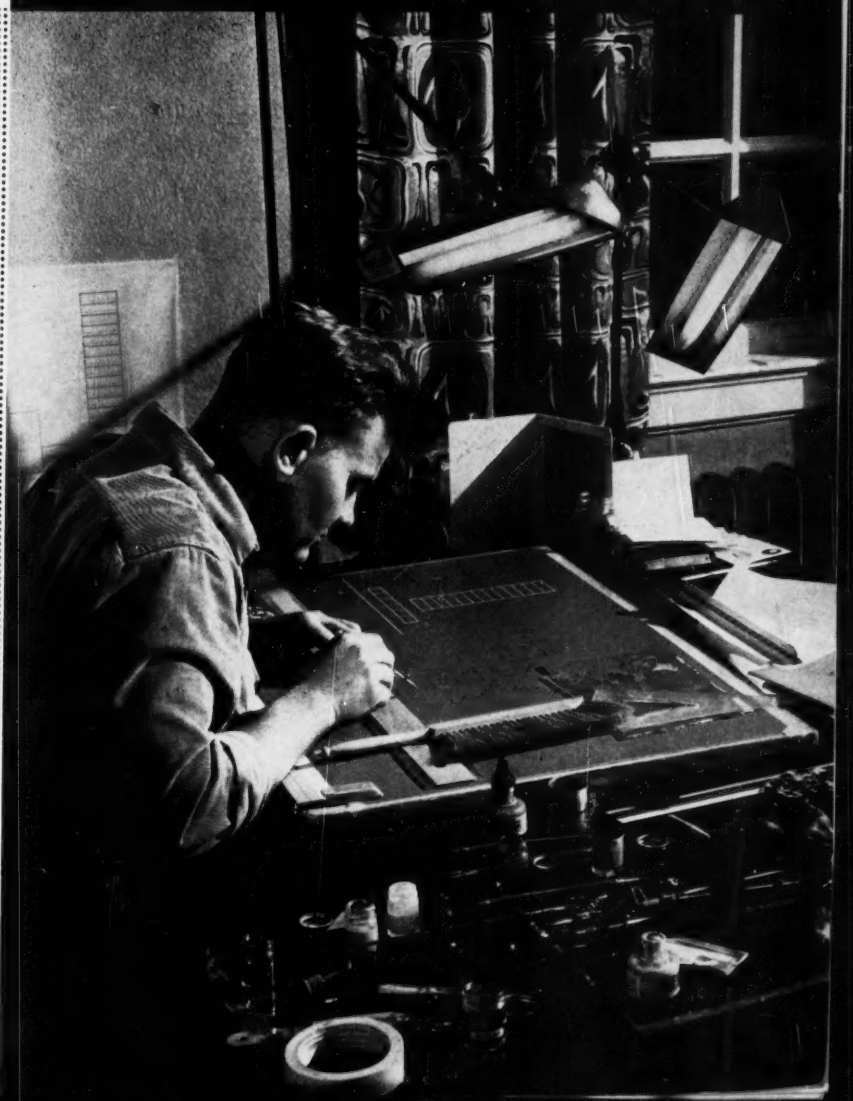

OCTOBER, 1952

VOL. 18, NO. 1

25 CENTS

Steel guinea pig about to have a breakdown

● We've come a long way toward licking the No. 1 enemy of steel—*corrosion*.

At United States Steel, for example, we've learned a lot through exposure tests, equipment service trials, accelerated laboratory tests, and the like. But there's just one way to be sure which grade of steel will give the longest service per dollar of cost on any given job: *try it under actual operating conditions.*

That's where the steel "guinea pigs" come in. Those expendable corrosion test racks are made up from a dozen or more different grades of steel separated by porcelain insulators that prevent galvanic action. We actually put the "guinea pigs" right into the operating equipment that contains corrosive liquids or gases. Then, when the steel specimens have been exposed to the service conditions for predetermined periods of time, we remove the guinea pigs, send them to the laboratory and determine the most economical steel for that particular service. To our way of thinking, this is the most accurate way to decide what grade of steel is the best buy for a particular installation.

Actual on-the-job corrosion tests like these have saved many thousands of dollars for refineries, textile and paper mills, food processing plants and other manufacturers to whom corrosion is an expensive headache. For these users, the cost of steel replacement has been lowered; and our customers have had fewer hours of lost production time due to corrosive failure.

This guinea pig test is typical of the many and varied research projects sponsored by United States Steel. Trained metallurgists in the field and in dozens of research laboratories are working to develop new steel compositions, and to solve problems involving the more efficient use of steel. United States Steel Company, 525 William Penn Place, Pittsburgh 30, Pa.

USS

UNITED STATES STEEL

Nature was working for you...a billion years ago

Age-old natural gas—changed beyond recognition by the hand of science—is in nearly everything that's new today

Geologists tell us that centuries ago mountains rose and crumbled . . . oceans formed and disappeared . . . and great masses of plant and animal life were buried under layers of earth, rock, and water. Gradually, chemical reactions changed that buried matter into oil and natural gas.

IT IS IMPORTANT TO ALL OF US—Natural gas came into its own within the lifetime of many of us. Its great importance began when scientists learned to separate and use its parts. Out of this work in the field of petro-chemistry came "Prestone" anti-freeze, the all-winter type that took the worry out of cold weather driving. Then there are today's plastics. Some are so soft and pliable that they make beautiful, long-lasting curtains and drapes for your home. Others are so tough and enduring that they are used to protect the bottoms of ocean liners. Natural gas products are important ingredients in nearly all of them.

FROM ANTI-FREEZE TO FUEL—Wherever you turn, there's something that's been made better by the magic touch of chemistry. It brings you many of today's life-saving wonder drugs . . . man-made fibers for exciting new textiles . . . hundreds of useful chemicals . . . and also "Pyrofax" gas, the modern bottled gas for home, farm, and industry.

UCC AND CHEMISTRY—The people of Union Carbide pioneered in producing synthetic organic chemicals. Today, their plants turn out more than 350 of these versatile chemicals for industry to use in making the things that serve you so well.

STUDENTS and STUDENT ADVISERS: *Learn more about the many fields in which Union Carbide offers career opportunities. Write for the free illustrated booklet "Products and Processes" which describes the various activities of UCC in the fields of* ALLOYS, CARBONS, CHEMICALS, GASES, *and* PLASTICS. *Ask for booklet I-2.*

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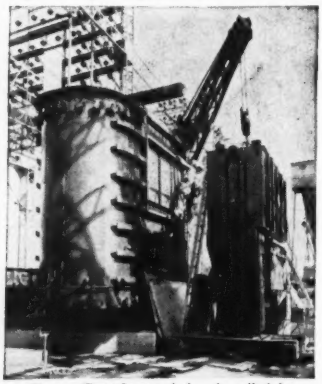
Make the First Job Count!

by PAUL CLARK
Application Engineer, Electric Control Section
WEST ALLIS WORKS
(Graduate Training Course 1950)
Iowa State—EE—1949

IT SUDDENLY occurred to me while I was a senior, looking for a job, that my first job would be all important. In a way, it was going to be almost as much a part of my schooling as my last year at "State."

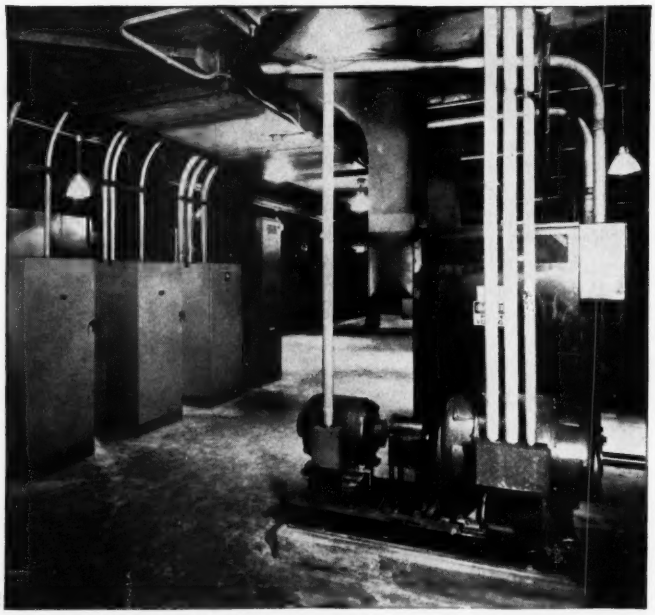
PAUL CLARK

Since then, I've been glad I thought of it that way, because that's what the first year and a half was . . . schooling. Among other things, I learned what I wanted to do, and learned a lot about products and industry problems. But I give much of the credit for the great amount I learned to the Allis-Chalmers Graduate Training Course and consider myself very lucky to have chosen Allis-Chalmers. Perhaps a quick review of my own experience will show why I feel that way.


Power Transformer being installed in Midwest utility.

After graduating from Iowa State in 1949

I started the Allis-Chalmers Graduate Training Course on the Steam Turbine erection floor. From there I went to the switchgear and pump departments to familiarize myself with other utility equipment; and from there, to the Motor and Generator section, which at the time was my goal.


Brain of a giant 107,000-kw steam turbo-generator is this complex *Regulex* voltage control. Clark finds such control a fascinating problem.

Arrange Your Own Course

From this, you begin to see the freedom a GTC student has at Allis-Chalmers. You not only have complete freedom in arranging your course, but you can change your course as you go along and your interests develop. Best of all, you have a wide choice, because Allis-Chalmers builds such a wide line of products.

Even after getting to the Motor and Generator section, which had been my original goal, I had a chance to change my mind. While I found a certain glamour to the big motors and generators, I became *really* intrigued by the electrical brains of these giants, and decided to go to the control section to learn more about them. I have been working there ever since.

Today, I am in charge of pricing, applying and promoting the sale of three lines of control devices: *Rocking Contact* voltage regulators; *Regulex* voltage regulators; and liquid rheostats. Part of my time is spent traveling . . . visiting customers and helping district office salesmen.

The time spent in other departments has paid off too. It not only helped me find the work I liked best, but I met people in departments all over the plant that I now work with in coordinating jobs for utilities. Even time on the Steam Turbine erection floor proved valuable, because it helps me in talking shop to utility men.

Wide Choice at A-C

One reason you have such a wide choice is the fact that Allis-Chalmers makes equipment for every basic industry, including electric power, cement, mining, rock products, flour milling, and steel. Just to give you an idea, here are some of the products you might some day redesign, build or sell: transformers, steam condensers, pumps, motors, blowers, unit substations, steam and hydraulic turbines and generators, crushers, kilns, grinders, coolers, rolling mills, sifters, and many others.

That diversity can mean a lot to you in helping you find the job you want. It certainly helped me make my first job count.

Rocking Contact and *Regulex* are Allis-Chalmers trademarks

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For information call the Allis-Chalmers District Office in your locality or write to
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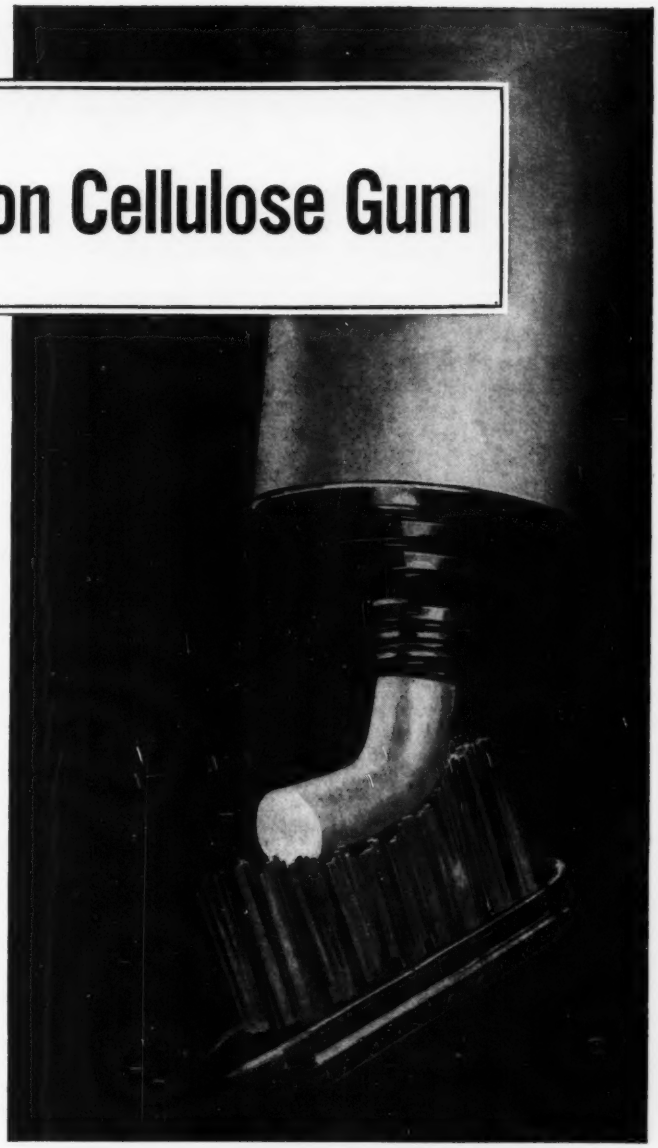

PROBLEM . . .

. . . to discover a domestic material for blending the many ingredients of modern-day toothpastes, shampoos, lotions, and other cosmetic preparations.

SOLUTION . . .

. . . cellulose gum—pioneered by Hercules. Added in very small quantities by manufacturers to their formulations, cellulose gum simplifies production.

COLLEGE MEN . . .

This is but one example of the far-reaching chemical developments in which you could participate at Hercules—in research, production, sales, or staff operations. It suggests the ways Hercules' products serve an ever-broadening range of industries and end-uses.

Hercules' business is solving problems by chemistry for industry . . .

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Where Are The Women?

Last year, of some 40,000 engineering degrees granted, only 77 went to women. Yet, in hundreds of colleges throughout the country are analytically minded young women enrolled as math or physics majors or perhaps as students of the humanities or even home economics—many of whom would have become capable engineers if they had been of the opposite sex.

The furor raised during the past year over the drastic shortage of engineers is an old story by now, but the situation is expected to continue for a good many more years. Surveys indicated a shortage of over 40,000 engineers last spring with a probable continued deficiency for the next five to ten years. Instead of looking for jobs like other graduates, engineering students found their services the object of industrial competition. Most engineering graduates had at least half a dozen offers, with an average starting salary of $350 a month. Large companies were offering to hire entire graduating classes; men about to be drafted were signing promissory contracts for the future.

Not so long ago, it seemed to be generally true that a company preferred to hire an inferior male engineer than a good woman engineer, in spite of the fact that women like Edith Clark and Lillian Gilbreth proved themselves capable in this masculine profession. But today, with the draft sapping our manpower and with industry hiring engineers for a wide range of positions (40% of industry's management personnel are engineer-trained), women are being looked to for possible help in meeting the demand.

It is up to each engineering-minded high school girl to decide for herself 1) whether she thinks she has the qualifications which would fit her for an engineering education; and 2) whether she has the interest and determination to go through with that education. However, the high school graduate has to depend to a great extent on the advice of parents, friends, and teachers; in many cases, a girl has not had the chance to find out whether she has more than an infatuation for a particular engineering field and whether she has any real ability because of the discouraging, out-of-date ideas of her elders. Many girls have instead been satisfied with theoretical math and physics courses which, unless supplemented with an unusually large number of technical electives, give little opportunity for acquiring the common-sense, practical knowledge so necessary for industrial research . . . or for learning anything beyond the pure science training useful chiefly for a teaching or pure research career.

If a woman has the same interests and capabilities as a man, why should she not have the same opportunity to develop these interests? True, a woman has to be able to adjust to the idea of "going it alone" (though she will soon attain the respect of her male classmates and her instructors if she shows real interest), and she may face difficult situations when she enters into a career . . . and finally she perhaps will have the challenging problem of trying to combine marriage and a career. But balanced against these is the satisfaction of acquiring a better understanding of her physical environment and the tools with which to create in that environment as well as the confidence of being able to work alongside her fellowmen and . . . even if she gives up her career for marriage . . . the satisfaction of having an education in a field which holds her chief interest.

It is often said that engineers are too much limited by their rigorous technical education; however, the five-year program such as Cornell offers (particularly the Engineering Physics course, which, with its combination of down-to-earth engineering training and a broad scientific foundation, is excellent technical training for a girl) enables students to take a large number of liberal electives. Along with developing the ability to understand physical phenomena no student of the humanities could ever undertake to investigate on his own, the engineer, male or female, is encouraged today to develop his interests in the arts and in general participation in college and community life so that he may continue broadening his education and experience after he graduates from college.

Women are generally considered to be of more meticulous nature than men; their approach to problems may be somewhat different. They may not be able to fit as easily into engineering management positions, but they can and have surpassed men in ability and achievement in many realms of technical work. There is no reason why women should be more satisfied than men with routine drafting or computing work. Women are capable of much more with the proper education and a certain amount of determination . . . and imagination.

The situation today is critical. The women of this country have had to assume no obligations in their country's defense mobilization program, as they have elsewhere. Yet they have equal rights and supposedly equal opportunities in the political, social, and economic structure of this nation . . . and they certainly have ability. So why should they not make use of it?

J.B.

Uniformity gained by "Centrifugal Casting"

The great majority of cast iron pressure pipe produced today is cast centrifugally, in metal or sand-lined molds.

When this mechanized process was introduced 27 years ago, its potentialities for improved production controls were evident. For human fallibility was largely replaced by machine accuracy based on scientific principles.

The improved production controls made possible by the centrifugal casting process have long since been realized. Hundreds of millions of feet of centrifugally-cast-iron pressure pipe are now in service. All of this pipe is more uniform in metal structure, in wall thickness, and in concentricity, than pipe not centrifugally cast.

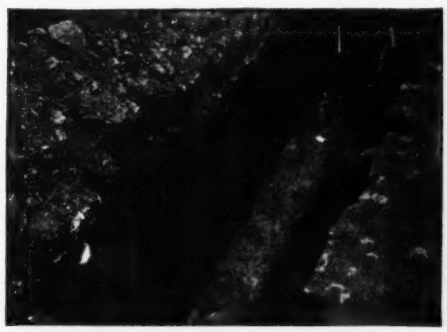
Better production control means better pipe; it results in greater uniformity of quality.

Production controls in cast iron pipe foundries start almost literally from the ground up with inspection, analysis and testing of raw materials; continue with constant control of cupola operation by metal analysis; and end with rigid tests of the finished product.

By metallurgical controls and tests of materials, our members are able to produce cast iron pipe with exact knowledge of the physical characteristics of the iron before it is poured into the mold of a centrifugal casting machine.

Cast iron pipe is the standard material for water and gas mains and is widely used in sewage works construction.

Send for booklet, "Facts About Cast Iron Pipe." Address Dept. C., Cast Iron Pipe Research Association, T. F. Wolfe, Engineer, 122 So. Michigan Avenue, Chicago, 3, Illinois.



Section of 114-year-old cast iron gas main still in service in Baltimore, Md.

CAST IRON PIPE SERVES FOR CENTURIES

To The Frosh

A Guide for the future -- *after* June, 1957

The CORNELL ENGINEER wishes to extend a hearty welcome to the members of the class of 1957 and congratulates them upon their admission to a school with a proud history of leadership in technical education.

As college freshmen most of you probably wonder what the exact nature of your curriculum will be and just what the engineer does when he enters the professional world. No doubt, though, you are familiar with the tale that engineers are mostly an uncultured lot, whose thinking must necessarily be restricted because of an education which is heavy on the technical side. The engineer is also envisioned as existing in a mental cocoon, too wrapped up in his work to emerge and meet the rest of the world on common ground. Although there has been much of this haphazard generalization of the profession, *some* of the criticism can probably be justified. However, if this fact seems discomforting, do not, by any means, feel that you will be forced into the same pattern merely because you have chosen to study this particular field.

First, it should be pointed out that engineering training emphasizes integrity, simplicity, practicality and orderliness in the application of technical knowledge. The student who appreciates the importance of these attributes and applies them wisely in the solution of technical problems will also find them invaluable aids to straight thinking on all matters. In fact, a high percentage of engineers have achieved success in fields other than applied engineering, such as business and industrial administration and management.

On the other hand, it must be acknowledged that most engineering curricula are rather inflexible due to the large number of required courses which they must contain in order to cover adequately the technical material. This prevents the inclusion of more liberal arts and non-technical electives—one of the prime reasons that many engineering students lose sight of the tremendous world of learning about them. Therefore, they actually do receive a one-sided education. Such a state of affairs, however, need not and should not exist.

Here at Cornell the five-year program, one of the first to be installed, has accomplished much in the way of broadening the engineering curriculum. While still in a process of evolution, it has been very successful thus far in combining technical and non-technical study. In addition, the number of liberal electives has been substantially increased. But the new program has not provided the entire answer; the fact remains that only so much can be accomplished even in five years—that is, accomplished in the lecture halls. There remain available on the campus, however, numerous extracurricular opportunities with which you may supplement and enrich your formal classroom education. As freshmen you should be aware of the wealth of knowledge that can be had for only a little extra investment of your time. If exploited, it can yield rich dividends in learning and help to balance out the heavy load of technical work you will be carrying.

Consider the great many activities which are an integral part of the daily life of the college community. No matter where your interests lie you can be sure to find some organization on campus with which you can work and share those inetrests. It might be noted that Cornell engineers have established an outstanding record of leadership and responsibility in campus affairs, especially on publications and in student government. What better way is there to get to know your classmates as people rather than as students? Warm friendships flourish easily in the media of mutually-shared interests.

Guest lectures, seminars, and discussion groups also comprise an important part of the extracurricular program. They cover the widest range of topics imaginable and are both provocative and informative. Here you will have the opportunity to meet and speak with prominent personages who visit the University to lecture on their respective fields. Much of the information disseminated in this manner is particularly valuable since it cannot easily be obtained otherwise. Among other things, the lectures and discussions provide an excellent means of keeping pace with current events and shed new light on domestic and world affairs, of prime import to all of us at this time.

It should also be mentioned that you may be able to fit extra courses, which interest you, into the regular curriculum if it can be arranged. Many engineers overload their programs to do this, or else sit in on courses in their own spare time. There is no limit to what can be accomplished in this manner.

During the next five years at Cornell, it would do well to keep in mind the fact that one of the primary aims of any university is to graduate intellectually and emotionally mature young men and women, capable of assuming the responsibilities of our society. It is therefore essential that you develop a keen sense of proportion and appreciation of the environment in which we exist, as indispensable supplements to your engineering training. To accomplish this, will naturally require extra effort on your part; however, it will decide the difference between a run-of-the-mill engineer and one who possesses the depth and perception to succeed in his chosen field without divorcing himself from the rest of the world and its attendant complexities. Which one will you be? D.S.

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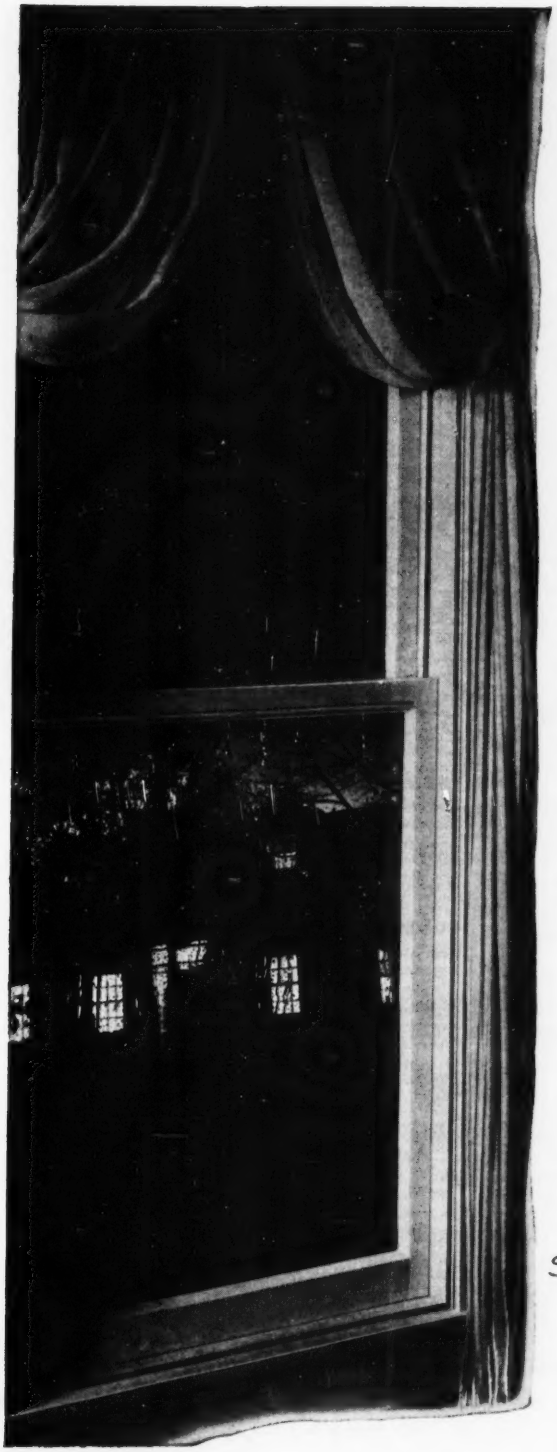
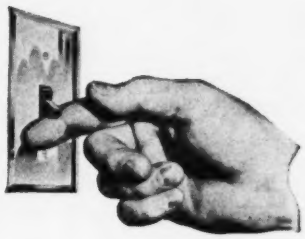


Gloom chaser . . . that works



Fair weather or foul, when you flip a light switch you *expect* light. You take it for granted. Actually, like a touchdown in football, the result is the triumph of teamwork in electrical apparatus.

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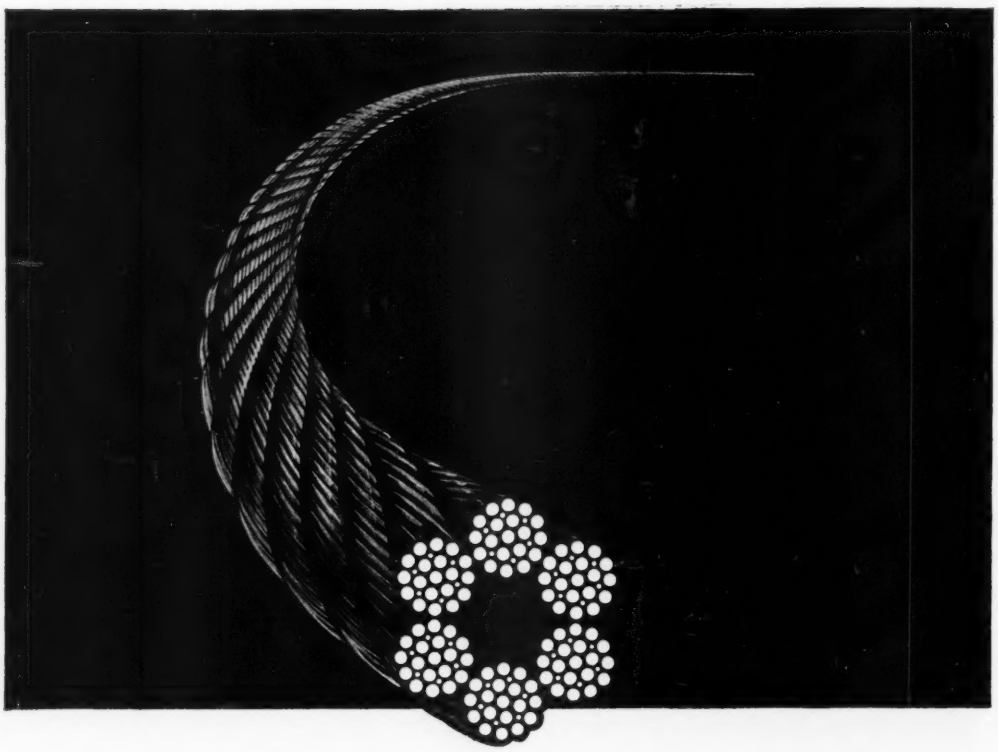
Insulator (left) made from Grade X Black Synthane for Square D Company and switch mounting plate made for Cutler-Hammer Inc. of Grade GLCC-M Synthane. Both parts require good electrical characteristics.

Synthane-one of industry's unseen essentials

SYNTHANE

LAMINATED PLASTICS



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"Of our Student Council, that is.

"That's him over there, passing out his campaign handbills like an alderman passing out cigars.

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"But our new Civics teacher, Mr. Leszczynski, has a theory that we'll learn a heck of a lot more about government and Americanism if we have less reading and more *doing*.

"He started out last year by making two school Parties . . . conventions, platforms and all that. And, while we had a lot of fun with our elections, we learned a lot about government at the same time. We've even got a regular Congress . . . with teachers in our Senate and us pupils in our House of Representatives. All elected by us, too.

"One of the things Mr. Leszczynski keeps drumming into us is the Bill of Rights of the Constitution. He's pretty hot on the subject of our Freedoms . . . religion, press, speech and the rest. He practically *begs* us to appreciate those Freedoms *every* day of our lives, not just on the Fourth of July and on Thanksgiving Day.

"He's not so dumb, either. He must've figured we'd sort of take our lessons home and pass them along to our families. 'Cause since he came to our school, our Parent-Teacher's meetings have been standing-room-only.

"And last regular Election Day in town, more'n 80% of our parents voted. I know both of mine did . . . and so did my big brothers and sisters.

"The funny part about it is . . . *Mr. Leszczynski wasn't even born an American!* But he never misses a chance to vote or take an active part in civic affairs. And he keeps reminding us he had to come to *this* country to find out what Freedom really means.

"To show you what us kids think about him . . . he's the *only* teacher we don't have a nickname for behind his back."

REPUBLIC STEEL

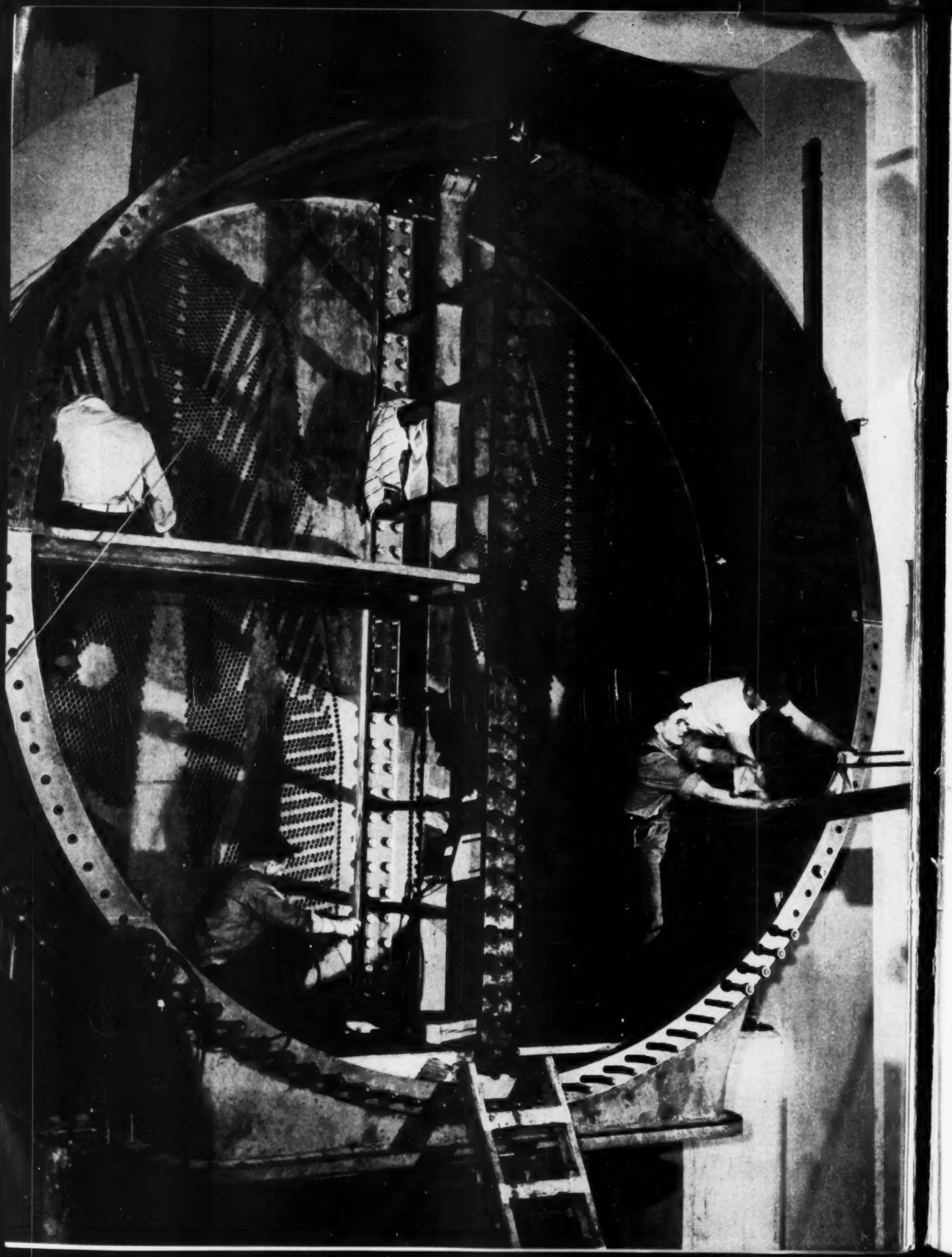
Republic Building • Cleveland 1, Ohio

REPUBLIC STEEL

Republic BECAME strong in a strong and free America. Republic can REMAIN strong only in an America that remains strong and free . . . an America whose people enjoy the many fine products of a modern Beverage Industry. *And, through the Beverage Industry, Republic serves America.* Many, many tons of its carbon, alloy, and, especially, stainless steels are formed into vats, tanks, mixers, bottling machines, vending machines, cans, shipping containers and dispensing equipment. Steel equipment like this makes it possible for Americans to enjoy their favorite tasty and refreshing beverages the year 'round.

* * *

For a full color reprint of this advertisement, write Dept. H, Republic Steel, Cleveland 1, Ohio.



More Power to You

By PAUL W. THOMPSON, M.E. '10

In 1910, when my professional life began, the electric power industry was still a fledgling. Today it stands high in comparisons with many industries of our country.

The birth of the industry occurred but 68 years ago, when Thomas A. Edison's work with electricity and his invention of the incandescent lamp resulted in the establishment of the Pearl Street Station in New York City. In the short space of a man's lifetime, the electric industry has advanced amazingly from that beginning and is now a cornerstone of our modern civilization, providing an essential service to every segment of American life. Our unparalleled standard of living, our ability to produce goods, and our high hopes for even greater progress in the future depend in no small way on the use of electrical energy.

There are 300,000 employees working in the investor-owned electric companies that operate 80 percent of the installed capacity in the United States. It has taken 17 billion dollars—over $50,000 per employee—to provide the plant used by them for the production, transmission and distribution of electric energy.

A list of owners or stockholders would have the names of 3 million people from every walk of life who have pooled their savings to make this business possible. There is also an unknown number of people who have provided capital through the purchase of bonds. In addition, an estimated 100,000,000 people who, as life insurance policyholders or depositors in mutual savings banks, have an indirect financial interest through the holding of investments by their respective institutions.

This 17 billion dollars of investment is 39 percent of the amount invested in manufacturing plants of all kinds thrown together. It is four times that invested in primary iron and steel production plants—and eight times that in automobile and parts manufacturing.

While the product measured at a customer's meter is energy in the form of kilowatthours, we utility employes are continually aware that what we really sell is "service." The customer thinks of electricity in terms of the things it does for him. He judges its quality in terms of continuity and reliability of service, and of good voltage regulation.

An interesting thing about a kilowatthour that is an advantage over the usual manufactured product is that its design doesn't change. Production facilities do not, therefore, suffer the rapid obsolescence of plant resulting from such change.

Development Cited

The following table gives several

The end of a steam condenser for a large turbine generator.

ABOUT THE AUTHOR

Paul W. Thompson

Paul W. Thompson, Vice-President in charge of Engineering of The Detroit Edison Company, was born December 7, 1887 in Oxford, New York. He attended Oxford Academy and graduated from Cornell University in 1910 with a degree in mechanical engineering. From 1910 to 1913 he was instructor in senior engineering subjects at Cornell University. He was employed by Detroit Edison in 1913 as experimental engineer at the Delray Power Plant. Since that time he has held the positions of Technical Engineer of Power Plants, Chief Assistant Engineer of Power Plants, Chief Engineer of Power Plants and in September, 1943, was elected Vice-President in charge of Engineering of The Detroit Edison Company.

He has been the author of a number of miscellaneous engineering articles published in the technical press, and has presented several papers at the American Society of Mechanical Engineers' annual meetings.

national statistics for the years 1920 and 1950 that show the developments during that period:

	1920	1950
Energy in kilowatthours produced per capita	500	2500
Average kilowatthours used by a residential customer	350	1830
Power assisting each production worker in horsepower	1.3	8
Energy assisting each production worker in kilowatthours	3000	13000
Standard work week in hours	60	40
Percentage of farms electrified	4%	90%

Engineers have developed many new uses for electric energy, making it possible to do many jobs today that could not be done in 1920 or to do them much more economically than they were being done by other methods. The 13,000 kilowatthours of energy per year for each production worker is equivalent to the physical efforts of 75 to 200 men (depending on method of calculations) working 40-hour weeks for one year. But the cost of electricity used for manufacturing accounts for only ¾ of 1 percent of the selling price of the factory products.

Had anyone told me forty years ago that the industry would grow as it has I would not have believed him. But I have seen it and have personally experienced many of the problems associated with that tremendous growth. If you don't mind I shall reminisce a little and review some of the accomplishments that have made this great industry what it is today.

All the generating capacity needed for Detroit Edison load just prior to World War I could be supplied by one of the turbine-generators most recently installed. It has a capability of 125,000 kilowatts and is but one of thirty of varying sizes in the Detroit Edison system. It is obvious that needs for electric energy have grown much faster than the population itself.

Efficiency Cuts Cost

In my time, generating plants have improved so that we have reduced the number of pounds of coal needed to generate a kilowatthour from approximately 3 pounds to less than ¾ of a pound in the most efficient plants. It costs much more to build each kilowatt of plant capacity, and the price of coal has risen, but the cost of electrical energy has been reduced. For example— in 1915 when coal burned by The Detroit Edison Company cost an average of $2.21 per ton, a residential customer paid an average of 6.04¢ per kilowatthour; in 1950 when coal cost $7.89, the customer paid 3.08¢.

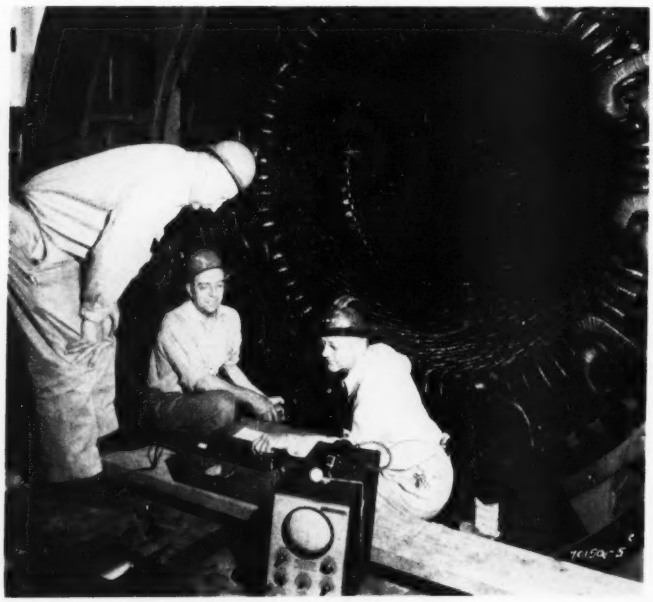
The increased efficiencies of thermal plants have been largely due to improvements in materials and methods that allow the use of higher steam temperatures and pressures. Today 2,000 psi pressure and 1,000 degrees Fahrenheit are not uncommon. As better materials and methods are devised, you will see still higher efficiencies. In a company such as ours that uses 4.2 million tons of coal a year, the engineer who can show how to increase the average efficiency of its power plants by 1 percent would effect a saving of $350,000 a year.

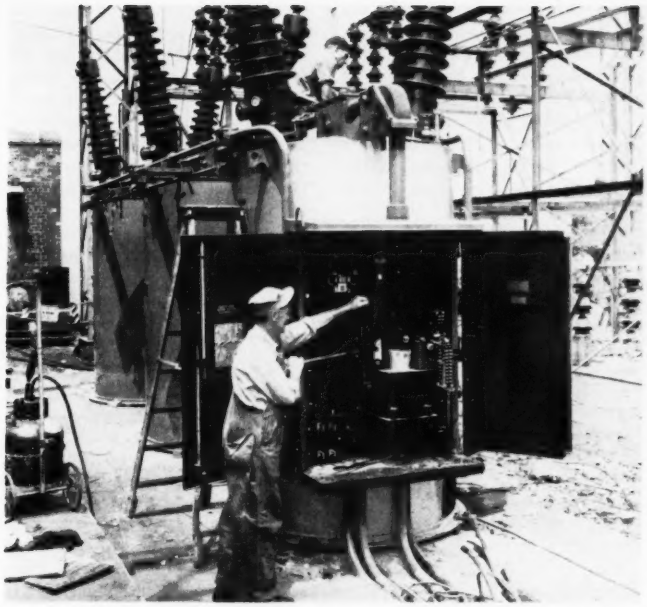
You can be sure that our engineers are continually looking for ways and means of reducing costs or improving service. Several of them in a cooperative development (one a young man who came to our company in 1946) have shown how to make an annual dollar savings that runs into six figures. We now make summer weather in the winter for our stoker fired steam generators by introducing steam into the combustion process. Through some phenomenon that we are not yet sure about, this reduces slag formation on tubes, thereby improving heat transfer. Additional savings result from reduced maintenance and shut-down time. I am sure that there will be other improvements in operation of existing plants that will show worthwhile savings.

I have seen boiler feed pumps as they came from the manufacturer wear out in two years. In our Research Laboratory of forty engineers and scientists who wrestle all kinds of utility problems, there is a metallurgist who went to work on this one. Suppliers have been assisted in developing alloys that will wear five times longer when used in their high pressure pumps.

When our urban load was 100,000 kilowatts and the distances not very great, we could transmit efficiently at the generator voltages, but as the load increased it became

Workmen shown here are running tests on the stator windings of a newly installed alternating current generator.





Equipment, such as this 13 Kv. circuit breaker, is constantly on guard to protect the electrical circuits of power consumers.

necessary to operate at higher voltages. Years were spent in developing insulation, underground cables and circuit breakers that would give good service at a transmission voltage of 24,000. As the loads grew, the 1200 miles of 24,000 volt cable had to be augmented with higher voltage transmission. We now have fifty miles of a 120,000 volt three-phase cable capable of carrying the output of two 100,000 kilowatt generators.

Insulation Developments

It is a long story—citing all of the problems and developments that brought into successful operation this new high-voltage underground cable system. The cables are buried in 8-inch steel pipe covered with a coating to prevent corrosion. The pipe is filled with 200 pounds of nitrogen pressure to improve the insulating qualities of the cable. The oil impregnated paper around each conductor is about the same in thickness as on the convential 24,000 volt cable. This makes for more efficient dissipation of I^2R losses.

Special joints and terminals had to be developed as well as methods of installation. The operating and maintenance problems that continually arise with equipment of this kind require the training and ingenuity of our best engineers for their solution.

For a long time the surburban transmission system handling bulk power has been a steel tower line operating at 120,000 volts. We foresee the time when that voltage may have to be increased to 220,000 or 287,000 volts. Introducing such a change into an existing system always brings with it new problems.

In the Detroit Edison service area of 7,500 square miles, 23,000 miles of transmission and distribution lines are carried on 579,000 wood poles. At one time the life of a pole was at best about 15 years. Todays poles are treated with chemicals that inhibit fungus growth. If pole life is only doubled, the savings are tremendous when you consider that it costs $150 to replace each old pole.

Then every so often comes a problem that makes the day-to-day ones seem small. Since 1946 the load has grown faster than any of us predicted at that time. When the Korean War hit us, we had plans for rebuilding a portion of an old plant. Removing some of the less efficient generators to make space for new ones meant reducing our capacity at a time when the load predictions made that seem unwise. New trends in automatic operation and defense considerations also favored the construction of an entirely new plant at another location. Suddenly plans were shifted to build a new fifth plant—the first new location in over 25 years.

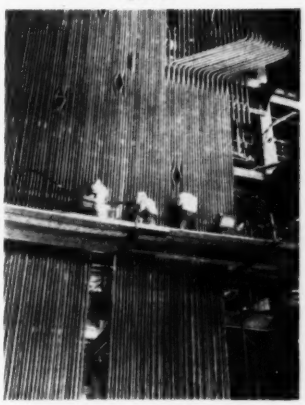
But it takes 3 years from the time you decide to build a new plant until you have it in operation. Economic studies were quickly made to decide where to locate it—fortunately we had already purchased land at two different places. Other important decisions related to temperatures and pressures that give the highest economy . . . to sizes of generators and boilers . . . to reheat cycles . . . to unit operation of boiler and turbine-generator . . . to 3600 rpm vs 1800 rpm and to an almost completely automatic type of plant.

Building a new power plant means changes and additions to parts of the transmission and distribution system. For every $1 spent for the new plant, $2 will eventually be spent in new lines, switching stations and substations that deliver the power to the customers.

I could go on citing a number of examples of engineering problems that at times appeared insurmountable, but now let's take a look at the future.

Electricity has become almost as

This boiler will soon be providing steam for a new turbo-generator to meet the ever-increasing demands for electrical power.



essential to modern living as food and clothing. It keeps production going in the factories, milking machines on the farms, and deep-freezes and furnaces in our homes. Engineers will keep on developing new uses which will build more electric load, and therefore more challenges for the electric utility industry.

In the United States the industry has doubled in size during the last ten years. Engineers and managers are making their plans today for a rate of growth in the next twenty year as great as that of the past twenty years. Under those estimates, the grand total United States capacity of approximately 80,000,000 kilowatts today will reach 200,000,000 by 1969. Property and plants will be worth $65 billion, and annual revenues $11.5 billion.

Future Outlook

It is no secret that there are now under way long-range studies on applications of atomic energy to production of electricity. If and when that happens, methods of steam generation will be changed and there will be new engineering and management problems. Of more immediate interest is the use of radioactive isotopes as tracers. Industry is on the threshold of a new method of solving many of the engineering problems, and it will be a young man's field.

Future growth and changes will bring opportunities and achievements greater than I have experienced during my 40 years in this buisness. Some of our engineers today feel that the engineering problems associated with the design, construction, operation and maintenance of power plants and electrical systems may grow even faster than the load. Opportunities for thinking up new ways of getting jobs done and of improving service and reducing costs will go on and on.

This is an engineer's business. The job of making and selling kilowatthours depends on the engineering science all the way from the source of energy to the customer's meter. Even the problems that are of an economic nature are associated with either materials or methods that require an engineering knowledge and background for their solution. The majority of top management positions will be filled by engineers.

In planning your career, keep in mind also that the place you work and the people you work with will have an influence on your success and happiness as well as what you do. The utility industry has long been a leader in employee relations and can point with pride to its achievements in that field.

If you are looking for a challenge for your abilities, and an opportunity for a lifetime of professional growth, those of us who are about to pass on the torch to younger men commend for your careful consideration this great industry. Along with glamour, there is security, and with progress—stability.

Letter and Brain Teaser

To the Editor:

Re: February Brain Teaser.

For the possible interest of Juniors, Seniors and Graduates may I add the two questions which follow hereunder?

(1) What was the total mileage of the bee's flights toward Geneva?

(2) What would it have been had the bee started from the Geneva car?

No matter in which direction the bee first started, at the end of the bee's first round-trip the distance between the two cars would have been 7/52 of their initial distance of 45 miles.

Consequently, the series of flights north is in geometric progression: so also is the series of flights south: and the common ratio of any series is 7/52.

Since the common ratio is less than unity, the number of terms in each series increases indefinitely. For the sum of such a series reference is made to Integral Calculus, which gives the following formula in which "a" is the first term, and "r" is the common ratio:

$$S = \frac{a}{1-r}$$

The answers to the questions above are:

1) 40 miles
2) 17.5 miles

F. Dusty, '98

February Brain Teaser: A car going 30 mph leaves Ithaca headed for Geneva, a distance of 45 miles away, exactly as a car leaves Geneva for Ithaca going 15 mph. At the time that the car left Ithaca, there had been a bee sitting on the hood ornament, but he took off, and flying at 50 mph, he flew up the road to Geneva, where he met the car coming from Geneva, whereupon he reversed his direction, and flew in the direction of Ithaca, until he met the car coming from Ithaca, and reversed his direction once more, etc. The problem: How far had the bee flown by the time the two cars passed each other?

We welcome Mr. Dusty's diversions for the junior, seniors, and graduates. Now will some alumnus contribute a Brain Teaser for the faculty? This month's undergraduate teaser follows:

A census taker stops at a house on Main Street to gather his information. He notes the house number. The man who comes to the door informs him that there are three other residents besides himself. The census taker asks the man his age and notes it in his book. He asks the ages of the other members of the household. The man declines to give their ages, but volunteers the information that the product of the ages of the three individuals is 1296 and that the sum of their ages is equal to the house number. The census taker reflects awhile. He is not quite satisfied. He asks, "Are you the oldest?" The man replies that he is. The census taker then deduces the ages of the other three individuals and goes on to the next house.

Problem: What were the ages of the three younger members of the household and what was the street number? The ages and the street number are integers.

(Answer next month)

Consulting Engineers in Selling

By FRANK W. HANKINS, M.E. '19

Billions of dollars worth of products each year are designed and produced by engineers, sold by engineers and purchased by engineers, but good engineering of the selling function is often lacking. To help industry correct this situation, marketing counseling (a relatively new profession) presents specialized training and experience. As applied to highly engineered industrial products, this new field offers to technical graduates attractive career possibilities.

"The god of the machine" is indeed the engineer and to him is properly credited the achievement of ever increased industrial productivity at decreased cost, not as measured in dollars, but in the real coin of fewer man-hours and less material. These masters of design and production are sometimes inclined to view the sales side of the business with tolerance and to consider those engaged in selling as a group of extroverts often troublesome, but (perhaps unfortunately) quite necessary. Or so it was some years ago.

Application of Engineering

More recently, industrial businesses have come to regard selling as a productive effort to which engineering methods can be profitably applied. This 'engineering' of the sales function is an area of business operation which can yield great rewards since selling has long been considered an art rather than a science.

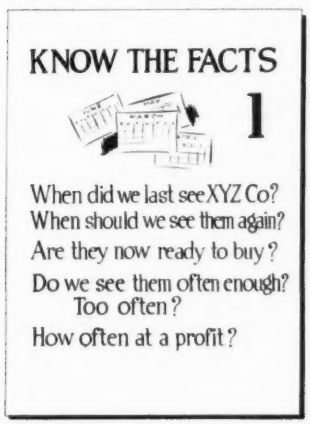
The sales plan is too often a haphazard patchwork of guesses, hunches and day-to-day improvisation—principally a blind following of competitive practices including competitive mistakes.

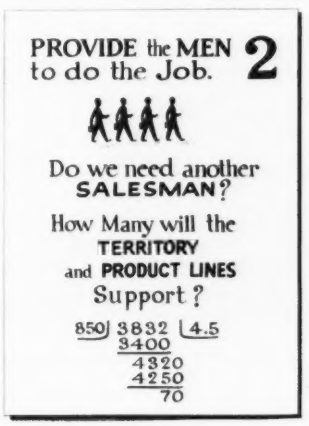
The newer technique is a painstaking accumulation of the facts, their organization into conclusions, the blueprinting of a sales plan based on these facts, and the monitored execution of the plan. And because a high degree of specialization is involved in such studies and in the creation of such sales plans, a new professional group has been developed to handle these special tasks. The men in this group function as consulting engineers in the selling field and are known as industrial salesmen or marketing counselors.

Services in Marketing

In this article, consideration is limited to those firms who offer their consulting services in the marketing of industrial products, where the buying decision is based on technical considerations and where the salesmen are usually engineers, in order to advance the technical justifications of their product and the benefits of their use.

With such products, few sales are made without the benefit of at least one visit and more usually several or many visits by a salesman. Sales planning is aimed at making these visits most productive. The sales consultant, working with the sales manager, can help in many ways.


KNOW THE FACTS
1
When did we last see XYZ Co?
When should we see them again?
Are they now ready to buy?
Do we see them often enough?
Too often?
How often at a profit?



APPLY THEM EFFECTIVELY to THAT JOB.
3
ARE SALESMEN trying to cover TOO MANY PROSPECTS?
Just for insurance?
Hoping for windfalls?
Waiting for personnel changes?
How can we find a common basis for management and men to come to an agreement?

A sales department in the line organization consists of a directing head, a vice president in charge of sales or a general sales manager, district sales managers, sales engineers, sales trainees and/or sales agents or representatives, distributors and jobbers. Staff personnel may include advertising manager, advertising agency, product specialists industry specialists and marketing counsel.

For most efficient operation, this sales department must know where, when, how to sell most profitably. Perhaps the most important of the three is "Where to sell?" because it is economically impossible to effectively cover every possible sales opportunity by sales visits. Even though it may be reasonably possible to blanket most potential customers by advertising and catalog distribution, selling must rely on placing the salesmen at the point of sale, face to face with the man or men who make the buying decision and must equip him with effective sales tools to convey to these men, with maximum impact, the desirability of his product. Therefore, although the selling function includes the selection, training and equipping of the salesman, the all-important job is to make certain that the limited time in which he can be in action (deducting time for travel and waiting) is directed at profitable targets.

Sales Planning

In periods of high business activity, selling has little time for creative efforts and declines to the level of response selling—the following up of inquiries and quotations inspired by needs the buyer has felt himself rather than needs of which sales efforts have made him aware. Sales departments are kept busy responding to these calls and sell on a brand vs. brand basis. Even in such periods, the buyer, to conserve his own time, will limit his inquiries to a few suppliers but usually will include those who have called upon him with some regularity. Hence the importance of intelligent planning of, "Where to sell?" In periods of lower activity, such planning is even more vital because of sharpened competition.

This seems so obvious as to hardly warrant emphasis, but many salesmen are assigned to a territory with only the record of previous sales to guide the expenditure of their most precious asset—time. Which customers to visit and how often they are worth visiting is left to his judgment. And from the sales manager's standpoint, the number of salesmen and therefore the size of the territories and the number of district managers are questions basically concerned with the same considerations.

So the question most frequently asked of the marketing counsel is "What is the size of the potential market?" The answer provides the whole basis of profitable sales planning.

Size of market is determined by widely different methods as follows:

(1) Educated guessing based on broad considerations of the general business cycle and particular industrial trends.

(2) Specific published data interpreted by well experienced judgment.

Except in the automotive industry and a few others, detailed sales figures are difficult to obtain. Even when it is possible to determine the gross volume of every company in a field, the product line of each is varied and the total sales volume includes parts and repair volume to a considerable extent. From such data the sales potential in a particular field is very difficult to determine.

(3) A field survey covering an extensive sample of the market to determine what share of the total market a given product is now getting and what portion it is potentially eligible to get.

The field survey in its detailed findings measures the acceptability of a product; why it is liked and why it is not liked; why people buy it and why they don't. In addition the survey yields similar facts on competitve products. It will always provide sales management with most accurate answers when the sampling is large enough to be representative and when the survey questions are thorough enough in their exploration to determine: Who buys? What Brand? How much? How often? Why?

Field Survey

Because the survey method provides the most dependable information, it is recommended whenever the management decisions involved warrant the expense.

When the sales manager knows the total potential market he can forecast the portion which he can

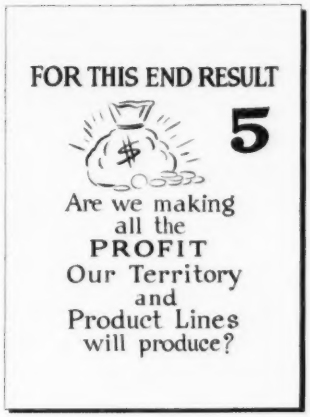
ABOUT THE AUTHOR

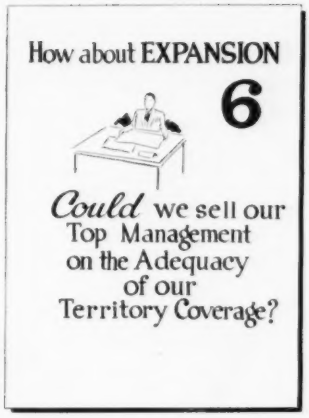
Frank W. Hankins was born in Auburn, N. Y. in 1897. He entered Cornell in 1915 and received his ME degree in 1919. Upon graduation he obtained employment with the Columbia Rope Co. in Auburn but became interested in the application of an engineering approach to sales problems. Many of the now basic concepts were developed during his thirteen years with the Worthington Pump Co. where he became Manager of Merchandising Sales. He became a consultant in this field in 1934 and organized his own company in 1938. His organization now serves fourteen firms selling to industry on a continuing basis.

Mr. Hankins is married to the former Evelyn Call, H.E. '19 and has three children; Ralph, Elizabeth, M.A. '52 and Philip, ME '53.

Frank W. Hankins

MAKE SURE each LINE GETS ITS FAIR SHARE of EFFORT
4
Considering GROSS PROFIT, do some Product Lines get Underemphasis?
Can we show proper evaluation of OPPORTUNITY
for
PROPER SALES EFFORT?
PROPER CUSTOMER SERVICE?
Are some lines misfits?





secure by organized effort. He can determine his sales budget and this tells him what manpower he can profitably employ to convert "his" portion of the market into actual sales. He can define his territories and locate his sales offices and warehouses.

The information the survey has given him on the buying motivation of his prospects added to his own knowledge and experience governs his choice of salesmen, advertising, sales promotion, visuals, catalogs and sales strategy. The survey has given him additional knowledge of competitors' strong points and weaknesses, and this enables him to place the most emphasis on his product distinction and value.

Finally, in making these many decisions involved in creating a complete sales plan, the sales manager has the advice of the marketing counsel who has dealt with many similar problems and is professionally expert in organizing, evaluating and interpreting the facts found by the survey.

Sales direction cannot become static even in long-established sales organizations. How best to introduce a new product, whether an old one should be dropped, whether to sell through direct salesmen, agents, distributors or some combination of these, are typical questions which arise. The sales manager is heavily engaged in a demanding job with its urgent day-to-day specific customer personnel and intra-company problems. The sales manager can rarely find the time to develop all the facts he would like to have in making his decisions nor can he employ his own sales force to obtain these facts. So, he turns to the outside consultant to get the job done. Moreover, it is done with an objectivity which his own organization could not have applied.

Example of Application

To cite an example, a manufacturer engaged a firm of marketing counselors to investigate the Pacific Coast area to which they sold through a single distributor. The question to be answered was, "Can we sell more profitably using direct company salesmen?"

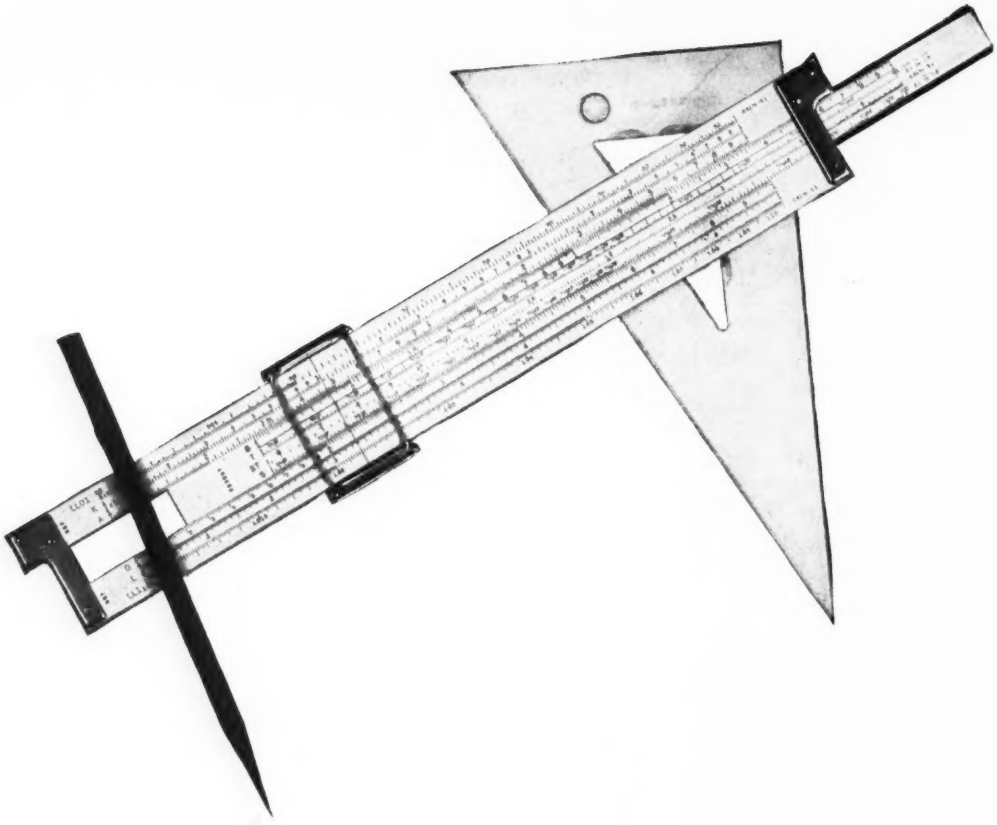
The necessary survey occupied six months. First, it was necessary to check by telephone several thousand buyers who were believed to be using products similar to those manufactured by the client. All those who were found to be users were visted in person. A substantial market was thus defined in detail. The strength of competitors was evaluated. Sufficient potential usage was forecast to warrant a warehouse, a district manager and eight salesmen in Los Angeles, a sub-warehouse with two salesmen in San Francisco and continued use of the previous distributor for sales coverage of the more sparsely industrialized sections.

The survey also provided a list of prospects with the individual potential of each firm to answer the salesmen's "Where shall I sell?" It also made is possible to divide the territory among the salesmen on a fair basis of equality of opportunity.

The client acted in accordance with these findings and the "pay-out" was rapid. Without such a survey the warehouse would have been located in San Francisco, the geographical center of the area served; this serious mistake was thus avoided. If less accurate means of determining the size of the sales force had been available, the result might have been costly. Too few salesmen would have missed potential opportunity needed for the "pay-out"; too many salesmen could have increased operating costs and denied to most of them an opportunity to show satisfactory results. Less exact territorial division would have created resentment and rapid turnover, costly to men and management. Four years later, certain portions of the same area holding anticipated new opportunities were restudied and additional salesmen and warehouse stocks were recommended.

This case relates in some detail only one phase of the marketing counsel service. Usually retained on a continuous basis (rather than for a single investigation), the sales consultant provides sales management with advice and service in the fields of selection and training of salesmen, methods of compensation for salesmen, sales organization revision, sales tooling and product design evaluation.

Any subject involved in selling more of the product at a lower selling cost is within the scope of the marketing counsel.



You'll find classmates—and a future—at Boeing!

Men from more than 120 top engineering schools are building rewarding careers at Boeing. So chances are, you'd be working with some of your classmates here. And in addition you'd be a member of an Engineering Division renowned for its trail-blazing contributions to both military and civil aviation.

If that's the kind of engineering prestige you'd like to enjoy, look into Boeing opportunities. This company has been growing steadily for 35 years.

It provides the finest research facilities in the industry. It offers you work on such exciting projects as guided missiles and the fastest known bomber in the world: the B-47 six-jet medium bomber, as well as the still-classified B-52 eight-jet heavy bomber.

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Aircraft Undercarriages

By WILLIAM H. BENTLEY, EP '54

Ever since the first heavier than air machine took to the air at Kittyhawk, North Carolina, in 1903, there has been a continuous series of technological developments giving us the present highly complex aircraft. The pace of this development necessarily was accelerated as time went on due to military demands and the increasing complexity of the problems at hand. The problems of high altitude flight, instrument control, fabrication of metallic structural members, choice of alloys for specific functions, and many other important problems of present-day flight were totally irrelevant in the design of early machines. One of the considerations of aircraft design, however, which existed in the first machine of the Wright brothers and exists as a major problem today is that of undercarriage construction. It is easily imaginable that a design problem, whic hexisted in wood and wire contraptions nearly fifty years ago, must now be of gigantic proportions in the heavy high-speed aircraft of today.

The Wright brothers solved the problem of take-off by using a greased slide with a skid on the airplane. The soft sands of the North Carolina beach easily effected a safe landing. This is a far cry, though, from the trick of catching a heavily loaded jet bomber, weighing more than one hundred and fifty tons and travelling faster than one hundred miles per hour, on a long thin slab of concrete, called a runway.

—Boeing

Most widely used landing gear arrangement, shown here on the B-50 medium bomber, is the tricycle gear with steerable nose wheel.

Major Design Features

As in many cases of design, particularly the design of high performance equipment, the features finally incorporated in the apparatus have been the result of a mutual compromise. The three major facets of undercarriage design, each of which may be improved at the expense of the other two, are: the mechanical operation of the landing gear as a machine in itself; the weight of the total undercarriage assembly; and, with an airplane of a certain weight, the effect on the runway caused by the undercarriage. It may be noted that cost is conspicuously absent from the above list of important features of a particular landing gear construction. It should be realized that the purpose of such design features is economy, whether it be the derfrayment of initial cost or operating cost, payload gain, or the reduction of loss due to failure. These criteria of construction are the means of arriving at such economy and many of the compromises of design are a direct effect of a compromise between modes of economy.

The actual configuration of a landing gear assembly may vary a great deal for different uses and weights of aircraft, but many of the mechanical problems are common to all. In general, most undercarriages employ the telescoping type of shock absorber in which either the main supporting member or members telescope, or the main support is rigid and the shock absorber is coupled through a lever system to the wheels. The latter is referred to

as an "articulated" undercarriage.

Drag Force Problems

When the aircraft just touches the ground, there is a large horizontal force applied to the wheels, opposite in direction to that of flight. This is the force which supplies the torque to bring the wheels from rest to spinning upon touchdown. A problem arises because this force, called the drag force, is often great enough to cause the shock absorbers to jam at just the moment when they are most needed. In many cases the initial shock is great enough to cause the tires to "bottom" and blow out.

This problem occurs in two cases: in aircraft with high landing speeds necessitating a high angular acceleration of the tire and wheel assembly, and large aircraft whose tire and wheel assemblies have a high ratio of moment of inertia to radius and hence a high drag force to accelerate them rapidly enough. During the past war, the German Air Force was plagued with this problem, originating primarily from the first of these reasons. They had developed several interceptor-fighter aircraft whose landing speeds were as high as one hundred and fifty miles per hour. Their attack of the problem revolved around two courses of action: the development of non-jamming shock absorbers, and the replacement of the conventional wheel supported undercarriages with those supported on skids. The refinement of shock absorber design proved adequate for shock absorbers to withstand moderately high drag forces, but was not a complete and final solution. Some difficulty always arose because of the various temperatures at which the mechanism might operate causing a variation in shock absorber fluid and lubricant viscosity. The method of skid-gear was used on the high-speed, rocket-propelled interceptor, the Messerschmitt Me. 163. The Me. 163 was heavy for an interceptor and the shock absorbers were poor enough to cause a considerable jar to both pilot and machine at the moment of touch-down. The acceleration of the landing jar is said to have been as high as six "G's" which often caused injury to the pilot. The idea of skids is one not to be wholly discarded for the future, though, since the saving in weight over a wheel assembly is considerable.

To date, the most permanent solution to the problem of shock absorber jamming is spinning the wheels by some means before touchdown. The wheels are spun either by a small electric or hydraulic motor mounted on the undercarriage, or by means of flap-like vanes on the side walls of the tires. These vanes use the relative wind velocity to rotate the wheel assembly. The additional weight of these flaps is very small and they do not detract appreciably from the pay load. Although the vanes do not accelerate the wheel assembly to a high enough speed to correspond exactly to the speed of the plane, they work well enough in many instances, particularly on small machines. In the larger aircraft, though, the extra weight and space of the motor drive is not of such great importance and ish outweighed by the advantages of attaining exact rotational speeds.

Tire Wear Cut

The system of spinning the wheels before touch-down also solves another highly important problem—that of excessive tire wear due to high drag forces. If the wheels of the largest aircraft were not rotating at the time of touchdown, it is doubtful whether the tires could withstand more than but a few landings. The addition of the motor drive unit then effects a great saving in tire wear and in initial cost of tires to resist such wear.

With the advent of high speed jet aircraft, there have been many changes in the general dimensions of the airfoil section, the trend being toward thin wings. This makes the problem of wing-stowed retractable gear and wing-supported undercarriages more difficult. The problem of adequate space for the landing gear assembly is greatest on jet fighters which have the thinnest wings. Flatness of the entire assembly, including wheel and tire, supporting members, shock absorbers and the retracting mechanism is very important. The problem of the lack of necessary supporting strength by the wing exists in the most recent high-speed jet bombers. Some of these new aircraft, such as the Boeing XB-52, have a gross weight in excess of three hundred thousand pounds. The wing would be totally incapable of housing an undercarriage large enough to support such a weight, and it would be incapable of providing a support for the aircraft through a concentrated loading such as is caused by a wing-supported undercarriage. A new undercarriage array was then needed on this type of aircraft. The landing gear which was developed is called the "bicycle" landing gear. The wheel assemblies of the bicycle gear are directly behind one another and are lowered directly from

The latest in experimental undercarriages is the bicycle gear of the Boeing B-47. Small outrigger wheels in wing wells serve to stabilize the plane.

—*Boeing*

—*Boeing*

Still another experimental type is this double bicycle gear on the XB-52. Light stabilizing wing wheels are also used on this jet bomber.

the fuselage. The aircraft is then in a state of semi-balance on the undercarriage. Very small outrigger wheels are lowered from a position well outboard on the wings. These small wheels do nothing to support the weight of the machine and serve only to keep the aircraft upright. The bicycle gear gets its support from the most rigid part of the airframe, the fuselage. Due to the fact that the wheels do not have to extend very far down, a saving of weight is accomplished because the supporting members are short. Compactness within the bomber or other large aircraft is not a highly important factor and the space occupied by the bicycle undercarriage is not critical. Both the Boeing B-47 and the recently built Boeing XB-52 employ the bicycle landing gear.

Braking Problems

The high speed aircraft of today must use wheel brakes on every landing to stop within the length of existing landing strips. All jet planes find it necessary to use the brakes quite extensively because the jet engine provides some thrust at any idling speed, and there is no propeller to provide any kind of drag or counter thrust. In a passenger automobile the longest distance the brakes are heavily applied is possibly two or three hundred feet. In an airplane, the brakes may be applied for several thousand feet at pressures up to those which cause the tires to skid. This requires the braking mechanism to be capable of dissipating large amounts of heat and to be free from "fading." The disk type of brake is used almost universally on such aircraft since it incorporates many of these desirable features.

The weight of the landing gear assembly has become as high as seven or eight percent of the total weight of the aircraft on large modern planes. Once the aircraft is airborne the undercarriage is nothing but dead weight, and any measure which will appreciably lighten the landing gear will effect a noticeable increase in the total payload. The use of tubular steel supporting members and special aluminum alloy wheels has done a great deal to alleviate this problem. There is a limit, however, in weight reduction for the conventional landing gear if it is to retain all of its necessary functions. Some of the more radical arrangements of wheel supported undercarriages have gone a long way in the direction of weight reduction. An example of this is the bicycle gear. The heaviest single items in the landing gear assembly, however, are the tire and wheel. This suggests that there might be some future possibilities in the use of the skid supported undercarriage.

Multi-Wheel Application

At the Boeing plant several years ago, when the first B-19, the forerunner of the "super-bombers" such as the B-29 and the B-36, was being rolled onto the taxi-strip for the first time, a then unprecedented thing occurred. The huge plane dropped right through the concrete! This showed that the weight distribution of the large aircraft of the future would have to be considerably increased in order that they might be used on the existing air fields. The solution was found in the use of a multi-wheeled undercarriage where a single wheeled one had been used before. This effectively reduces the stresses which are applied to the runway by the landing gear. Another advantage of the multi-wheeled undercarriage is the added security of having some reserve support in the event a tire should blow out. The only major disadvantage is that the multi-wheel assemblies are heavier than the single-wheel assemblies. Recently this has been partially overcome through the use of special alloys for the wheel.

The undercarriage is often overlooked in an appreciation of modern aircraft design because it, in only the most indirect ways, contributes to performance, and is in actual use only a small fraction of the total operating time of the aircraft. It is, however, the keystone of the aircraft in that it comprises the indispensable link between the ground and the air.

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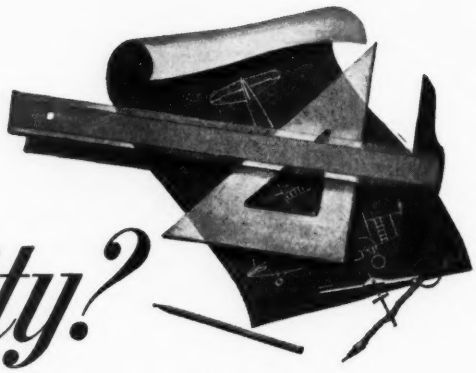

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GOODYEAR AIRCRAFT

Faculty Profile

By WALTER L. JONES, EP '55

Dean Thomas W. Mackesey

When given a long-term assignment or problem, an architecture student behaves like any other. Either he will enjoy his temporary freedom, seeing movies and relaxing, or he will toy with a multitude of various ideas, postponing the inevitable decision until the last possible moment. In either case, he will spend his last few hours frantically working to finish in time. One of the recent term problems that caused the midnight oil to burn low was the redesigning of the office of the College of Architecture. Perhaps some of the designers, while working over their boards, kept in mind the character of the office's principle occupant, Dean Thomas Mackesey.

The Dean is a short, baldish man of forty-three with a penchant for neatness and method in his surroundings. He has grown a small, but well trimmed brown mustache —in combination with the conservative suit he wears, adorned by a carefully folded handkerchief in the pocket, it gives him the appearance of a quiet, minor executive of some large concern. He speaks softly, and it is hard to picture him as being at all aggressive. But looks are sometimes deceiving, and his climb to his present post has been steady and rapid.

His desk is kept as clean as the jobs connected with his post allow. A modern gold pencil holder holds four colored mechanical pencils, and a streamlined, but not radical, lamp sheds light on his papers. A model shopping center done by a student hangs over his back. Below it is a long chart covered with red, blue and black pins by each student's name. It is his way of keeping an up-to-date record of every student's progress.

The rest of the office is not so up-to-date, not yet having felt the influence of Dean Mackesey's presence. Ancient wooden filing cabinets, dating from the early history of White Hall, fill the offices. A seventeenth century etching hangs on one wall. Pipes string across the ceiling above a bare floor. Old wooden desks and chairs, in keeping with the rest of White Hall, seem out of place in the office of a college of modern architecture. The wonder is not that Dean Mackesey wants to change the office; it is that he has taken half a school year to get around to it.

Young Thomas Mackesey attended Lynn Classical High School in Lynn, Mass., his home town. He was awarded a $2000 Pinkham Scholarship and from there went to the Massachusetts Institute of Technology. In 1932 he graduated with a Bachelor of Architecture degree and returned to Lynn to become a member of the firm of Conti, Mackesey, and Donahue, Architects and Engineers. He also served on the city planning board, rising to the position of supervising engineer in 1935. That year he returned to Tech to earn a master's degree in City Planning. After leaving M.I.T., he joined Messrs. Joseph T. Woodruff and Frederick J. Adams, associates on city planning, serving as consultants for New England towns. The next year he took another step forward in joining the New York State Division of State Planning. He served as Research Assistant and also as Secretary-Treasurer of the New York State Federation of Official Planning Boards.

In 1938 Prof. Mackesey came to Cornell, both as an instructor of city planning and as a student, majoring in Public Administration. Three years later he concluded his studies and was appointed Assistant Professor in Regional Planning. It took him just three years more to become an associate professor in the same field, and also to become Secretary of the College of Architecture. In 1946 he was made a full professor, meanwhile advancing in the college administration to the rank of Assistant Dean. Last May he reached the top of the ladder, Dean of the College of Architecture. In addition, he is assistant director of the Housing Research Center, which does research for industry and government, and chairman of the Architectural Engineering Council, which advises the University regarding its physical plant and expansions. All this is in addition

to teaching two lecture courses and criticizing student work.

Dean Mackesey's activities during the last ten years have not been confined to the campus. He has done consulting work for many New York cities, including New York (traffic control) and Brooklyn (Civic Center). He received a Wheelwright Fellowship from Harvard and helped lay out Sampson Naval Training Station. Finally, he is a member of several state and national architectural associations.

With all his varied duties Dean Mackesey doesn't find time for many diversions. What little free time he does have he devotes largely to his wife and four small boys. In the rare moments he has to himself he enjoys reading history.

But while he enjoys history, he cannot admit that historical influences have any place in modern architecture. He feels, instead, that modern architecture's purpose is to "build contemporary structures from contemporary materials." None of his students will be found designing Collegiate Gothic or Georgian structures. He places great stress on the individual's originality and style. The result is a "progressive" attitude in the college. It is not, however, a radical one, for Dean Mackesey also has an aversion to "stylism" for its own sake. Many architectural schools follow the Master-Disciple plan, with a great architect setting the style of his students, but Cornell does not. Outside of frowning on "archaic" designs, Dean Mackesey and his faculty allow students as much freedom as possible in their own designs.

Somehow, picturing a neat, methodical man such as Dean Mackesey in connection with the wild campus pranks of the architects seems rather hard. Perhaps no one will ever see him leading a hoard of green-haired men and women across the Quad chasing a giant snake on St. Patrick's Day. But when questioned about the antics of his charges, he will admit he favors them. "In a small group with such an espirit de corps," he says, "such outlets are completely normal." Normal? Only for an architect, as Dean Mackesey must truly be.

A Message From The Dean

By S. C. HOLLISTER

It is a pleasure to welcome you to Cornell as members of the Freshman Class in Engineering.

I am sure you have come to realize that you are entering now the most important period of your preparation for a lifetime career. The direction and shape of your future very likely will be determined to a considerable extent in your next five years at Cornell—five years which constitute the most productive investment you can make for a successful career. I cannot urge you too strongly to keep in mind that in this time you must establish a foundation upon which you can build a professional life for thirty, forty, or fifty years.

The engineering curricula at Cornell provide a superior educational preparation, second to none. They are designed to train for professional leadership, and as such they are demanding of our best mutual efforts. I can assure you that we are determined to work with you in every way possible to bring about the most effective kind of educational experience.

It would be unrealistic, however, to expect that the path will be smooth and troublefree for all. It is likely to be the most challenging you have ever attempted, but by the same token, also the most rewarding. For some the adjustment

S. C. Hollister

of these first few weeks may be difficult and perhaps even momentarily discouraging, but I want you to know that we stand squarely behind you, asking in return your own sincerity of purpose. You have been chosen for the engineering program at Cornell on the basis of a highly selective admissions procedure. We think you can become a Cornell Engineer, and our every effort is directed toward having you take your place in this distinguished family.

In urging you to your maximum effort I do not intend to sound an unnecessarily stern note. This is a joyous occasion and the beginning of one of the most happy and fruitful periods in your life. The opportunities for your personal development will be almost limitless. Cornell is a spiritual as well as an intellectual experience and I hope that you will take full measure of all that is here for you.

You are part of the almost minute percentage of young people your age who are in this most fortunate situation. I congratulate you on the opportunity that is before you. The College will watch your progress with warm interest and will assist you in every way to achieve your goals.

The 1952 Fuertes Speech Contest

On Friday evening, April 18, some very interesting speeches were presented by five undergraduate engineers in the final round of the Fuertes Speech Contest. This competition was the thirty-fourth held since its founding in 1912 by Charles H. Baker, C.E. '86, in honor of his friend and teacher, E. A. Fuertes, a former dean of the College of Civil Engineering. The contest is open to all students of the Colleges of Engineering and Architecture who are in the fifth term or beyond. Six of the judges are members of the faculty selected by the four Schools of Engineering, the College of Architecture, and the Department of Speech and Drama. The seventh is a prominent Ithaca business man selected by the President of the University.

As a general rule, the fifteen-minute speeches are not of too technical a nature, the contestants concentrating on the presentation, as desired by the founder:

> "A highly cultivated power of speech backed by fine personal character and a good presence is the most effective human instrument for commanding the respect, attention, confidence and appreciation of men and women everywhere. A strong and convincing presentation of weak subject matter may prevail over a weak and artless presentation of strong and more meritorious subject matter."

Janice Button, EP '54, spoke first on "Electronic Analogue Computers." After stating some of the new uses of computers in pure scientific research, industry, and government projects, Miss Button distinguished between the two main categories of computer— 1) digital, which makes use of numbers (usually the binary system) and 2) analogue, which utilizes physical quantities. She then concentrated upon the electronic analogue computers, explaining much of their operation. Many excellent symbolic diagrams were used, including slides.

Charles D. Simmons, E.E. '52, spoke next on "Ground Controlled Approach." He first stated that up to now, we have been quite limited by the weather as far as aviation is concerned, especially in landing. There are now two methods by which landings are assisted —1) radio beams which draw imaginary lines in the air (instrument landing system) and 2) ground equipment which locates the plane and then radios information to it (ground controlled approach). The latter system has the advantage of applying to all planes, since it requires no extra equipment in the planes. Mr. Simmons then described what the system is and how it is operated, making use of many diagrams. Several men are required to operate radar sets and are able to land a plane in three minutes. The speaker concluded by giving his opinion of what this equipment can do for the Ithaca airport, stating that although the system described is too complicated for our needs, a one-man system is available for $15,000. This would amount to only $15 for each plane landing in bad weather.

"A Comparison of Three Types of Loudspeaker Enclosures" was the topic of the third speaker, Peter H. Pincoffs, E.E. '52. The speaker began by distinguishing between the various types of enclosures: totally enclosed, bass-reflexed, and horn-loaded. Comparisons of the enclosures were then made, on both technical and non-technical bases. Several graphs were used in order to make the comparisons as clear as possible. On most of the technical considerations, the horn-loaded enclosure proved the best, followed by the bass-reflexed and then the totally enclosed system. However, on most of the non-technical issues, such as cost or ease of construction, comparison rated the speakers in opposite order. Mr. Pincoffs recommended the bass-reflexed as a compromise.

Next, Allen E. Galson, ME '53, spoke on "Memory." He described, with the aid of several diagrams, the physiological bases of memory and then gave some further examples of memory as it appears in various physical systems. Mr. Galson stated that the quanitities necessary for memory in any system, either human or non-human, are delay and feedback. The human system actually parallels quite closely possible electronic circuits. Some of the non-human memories stated by the speaker are the following: magnetic spots present or absent on a drum, as, for instance, to indicate binary numbers; square hysteresis patterns of ferro-magnetic materials; extremely complicated electronic computers; and, explained in greater detail, an industrial application connected with a punch press with which the speaker had worked.

The final speaker was Dale R. Pulver, Chem.E. '52, whose topic was "Engineering in Antiquity." Mr. Pulver began by defining engineering as an art and science by which the properties of matter and nature's sources of power are used to advantage by man. Although many believe that engineering is only a century old, it is actually over three thousand years old. The speaker outlined our great heritage as it came from four civilizations. The Babylonians were building dams across the Tigris and Euphrates before the birth of Christ. Then the Egyptians accomplished fabulous feats of civil engineering in the building of the Pyramids of Piza, three times higher than the Library Tower and made of sixty-

ton granite blocks. Next, the Greeks contributed widely in many fields. Archimedes discovered the lever; Hero invented the steam turbine; a pressure force pump was invented which was still in use at the turn of the century. A feat which especially captures the imagination was the movement of sixty foot 200 ton marble columns over several miles of rough terrain surrounding Athens and the subsequent raising of these columns in the building of the Temple of Diana. Last, the Romans left behind them 500,000 miles of roads which still survive today, as may be currently seen in "Quo Vadis." Eighty-four million gallons of water go to Rome daily through their aqueducts. The speaker concluded by stating that economic, military, aesthetic and religious considerations have all been part of the engineering mind.

The judges awarded first prize of $100 to Mr. Simmons, second prize of $40 to Mr. Pincoffs, and third prize of $20 to Mr. Pulver.

Professor E. B. Watson of the Mechanical Engineering school presided at the presentation of the contest speeches. Officiating as judges were Professors H. A. Wichelns, Department of Speech and Drama; K. W. Evett, College of Architecture; B. K. Hough, School of Civil Engineering; N. H. Bryant, School of Electrical Engineering; R. L. VonBerg, School of Chemical and Metallurgical Engineering; F. W. Ocvirk, Sibley School of Mechanical Engineering and Mr. P. W. Brainard, President, First National Bank of Ithaca.

Poetry Corner

Miss 1952

She's strapless for evening, for daytime, for beach,
And yet, sans the straps, her top sticks like a leech.
Don't credit her shoulders, her front so sublime,
Adhesive or thumbtacks—it's science THIS time.
The lads in the lab have abandoned old tech,
And the girders and tunnels and roll of the deck,
To take to some drafting that's more fun than bridges,
They've cantilevered all of Milady's cute ridges.
So all hail the strapless, the best news in years,
Coming straight from the space twixt the engineers' ears.
She'll dance and she'll swim or she'll run a fast lap,
Quite strapless, quite poised—and without a mishap.

The Enigmatic Engineer

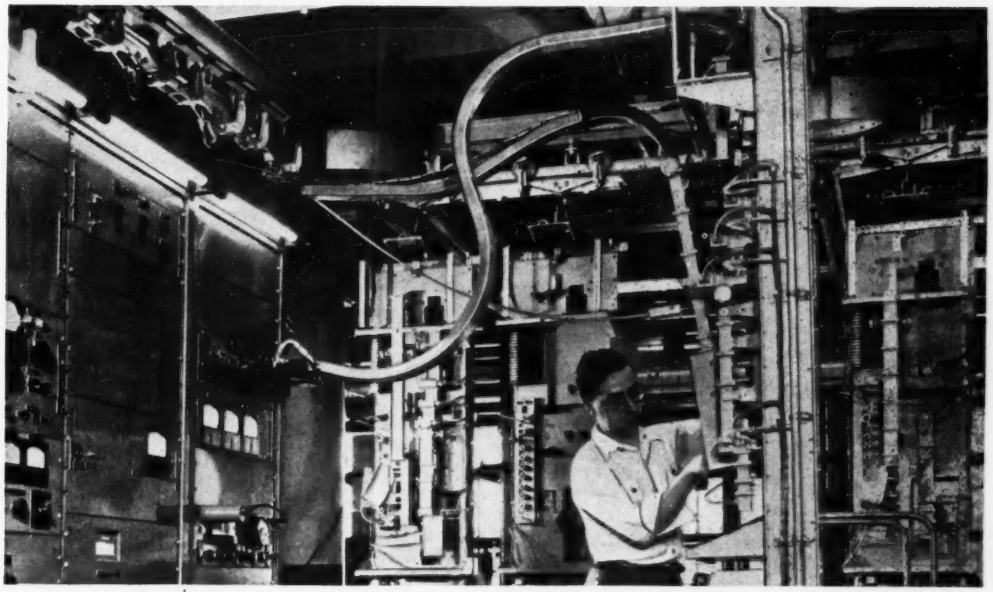
Verily, I say unto you, marry not an engineer.
For an engineer is a strange being and is possessed of many evils;
Yea, he speaketh eternally in parables, which he calleth formulae,
And he wieldeth a big stick which he calleth a slide rule.
And he hath only one Bible, a handbook.
He thinketh only of stresses and strains, and without end of thermodynamics.
He showeth always a serious aspect and seemeth not to know how to smile;
And he picketh his seat in a car by the springs therein and not by the damsels.
Neither does he know a waterfall except by its horsepower, nor a sunset
Except that he must turn on the lights, nor a damsel except by her live weight.

Always he carrieth his books with him, and he entertaineth his sweetheart with steam tables.
Verily, though his damsel expecteth chocolates when he calleth,
She openeth the package to disclose samples of iron ore.
Yea, he holdeth her hand but to measure the friction thereof;
And he kisseth her only to test the viscosity of her lips.
For in his eyes there shineth a far-away look that is neither
Love nor longing—rather a vain attempt to recall a formula.
There is but one key to his heart and that a Tau Beta Pi key;
When his damsel crieth of love and signeth with crosses, he
Taketh these symbols, not for kisses, but rather
For unknown quantities.

As a boy he pulleth a girl's hair to test its elasticity,
But as a man he discovereth different devices;
For he counteth the vibrations of her heart-strings and
He seeketh ever to pursue his scientific investigations.
Even his own heart flutterings he counteth as a vision of beauty,
And enscribeth his passion as a formula;
And his marriage is as a simultaneous equation involving two
Unknown and yielding diverse results.

Verily, I say unto you, marry not an engineer.

Where engineering and pioneering go together!



The transmitter-receiver bay unit being worked on by a Western Electric tester, is part of the complex equipment installed in the Bell System's coast-to-coast microwave relay towers. Special testing equipment is at the left.

Operator inspects a grid blank. The grid controls the flow of power through the tiny electron tube which is the heart of radio relay. Western Electric engineers designed machines to wind wire .0003 inch in diameter on the grid at 1000 turns per inch—spaced exactly .0007 inch apart.

COMPLETION last Fall of the Bell Telephone System's coast-to-coast radio relay route climaxed a production feat that involved doing many things never done before.

The engineers at Western Electric—manufacturing unit of the Bell System—were treading on uncharted ground when they tackled the challenging job of making the highly complex equipment.

This radio relay equipment—which transmits telephone and television signals at a carrier frequency of four thousand megacycles per second—called for many components never made before and for which no machinery, no tools, no assembly processes were known. Some components required almost unbelievably tiny parts—and fantastically small tolerances.

Manufacturing facilities and techniques had to be developed to assemble and wire the complicated equipment which receives signals having less than 1/10 millionth of the power of an ordinary flashlight bulb—at frequencies ten times as high as those used in television sets—amplifies these signals 10 millionfold and transmits them to the next tower some 30 miles away.

Finally, Western's engineers were responsible for installing the equipment in 107 towers across the nation.

In all phases of this job, engineers of varied skills worked closely together as a team which just wouldn't be stopped merely because "it hadn't been done before." That's typical of work at Western Electric—where engineering and pioneering go together.

Western Electric

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K. J. Nelson

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish closer relationship between the college and the alumni."

The serious problem of producing a sufficient supply of qualified engineers for our economy has been receiving wide attention in the technical and lay press. Dean Hollister sounded the warning about the shortage of engineers several years ago. He has continued his outstanding work in studying this problem and means for its solution. It was, therefore, extremely informative to obtain a first hand report from the Dean at the Society's annual meeting covering the most recent studies which look beyond the immediate shortage problem.

On the basis of predicted future enrollments in colleges and universities, the effect of the military draft, and competition from other professions requiring students of high scholastic aptitudes, these studies indicate a continued and growing shortage of engineers for many years to come. To minimize this shortage a strong effort must be made to interest qualified students in engineering. This will assure that our profession will receive its fair full share of such students. Since numbers of qualified graduate engineers will still be deficient, it is necessary for industry to find means for improving the utilization of engineers. In this connection there appears to be a real need for training programs by our educational institutions for supplying technicians to assist engineers. We must take a lesson from the doctors and lawyers who employ technicians and clerks to unburden professional people from routine task for devotion of their time to creative and responsible work. In addition, engineers must be furnished with and make effective use of suitable mechanical aids, such as automatic computors and analyzers, so as to reduce engineering man hours per project.

It appears that our Society and its individual members have a real responsibility in solving this manpower problem. We certainly can and must interest and inform prospective students on engineering through daily contacts. In addition, we should cooperate with our local secondary schools and with secondary school committees in operations by Cornell clubs to carry out information programs and arrange for visits to plants where prospective students can see engineers at work.

Your membership in this Society, attending its meetings and reading the CORNELL ENGINEER magazine are important means of keeping informed on engineering activities, particularly at Cornell. Furthermore, it provides needed support to permit the Society to increase its efforts as an organization to promote the welfare of our College so that it will maintain and improve its position to carry out its vital educational responsibilites.

K. J. NELSON

ALUMNI NEWS

New officers of the Massachusetts branch of the Cornell Society of Engineers are: Chairman—**Henry Gally, Jr., C.E. '34,** of 14 Ingersoll Rd., Wellesley, Mass.; Vice-Chairman—**James R. Clarke, Jr., M.E. '26,** of Westford Road, Concord; Treasurer—**G. Milton Benson, C.E. '22,** of 135 Langly Rd., Newton Centre; Secretary—**Norman W. Barrett, C.E. '14,** of 6 Old Dee Rd., Cambridge.

Robert H. Knowlton, C.E. '06, has been elected chairman of Connecticut Light & Power Co., 36 Pearl Street, Hartford, Conn.

William G. Seyfang, M.E. '09, is managing engineer of the Board of Education in Buffalo, where he lives at 116 Dorchester Road. He is a member of Aero Club of Buffalo, Gyro Club, American Society of Civil Engineers, American Society of Mechanical Engineers, and American Society of Heating and Ventilating Engineers.

Albert J. Blackwood, M.E. '24, assistant director in the research division of Standard Oil Development Co., has been appointed to

Albert J. Blackwood

the sub-committee on aircraft fuels of the National Advisory Committee for Aeronautics. He and Mrs. Blackwood live at 1005 Boulevard, Westfield, N. J.

Thomas S. Hauck, '10, after a varied career as an engineer, including an extended tour of duty with the Isthmian Canal Commission, is now a retired branch manager of the United States Plywood Corp. He served as a first lieutenant with the 603d Engineers in World War I and a captain and post engineer at Fort Eustace, Va. in World War II. The Haucks live at 5100 North Charles Street, Baltimore 10, Md.

Leonard Miscall, C.E. '19, has been sent by the United Nations to Ecuador as government advisor and consultant on public works, including the development of a highway system and of port facilities, and the opening of basic industries such as mineral deposits. This service is Mr. Miscall's most recent in a long series of activities abroad which took him to China, France, Germany, and Mexico, and other countries. At home in Ithaca, he has been a member of the city's board of public works and chairman of the planning commission.

William M. Welch, M.E. '21, has been promoted to district manager of the North Philadelphia commercial district of Bell Telephone Co. of Pennsylvania, 1835 Arch Street, Philadelphia 3, Pa., and lives at 742 Sunset Road, Glenside, Pa.

Frederick W. Parker, Jr., M.E. '27, has been appointed executive vice-president of Timken-Detroit Axle Co. He has been with the firm for twenty-five years, serving successively as sales engineer, service manager, and assistant to the president. His address is Box 252, Highland Park, Ill.

Robert S. Taggart, C.E. '29, has received the Bronze Star Medal in recognition of his services as sanitary engineer to the Eighth Army in Korea. Since his return to the United States, Mr. Taggart has been employed in the sanitary department of the National Biscuit Co. He lives at 14 Grand Place, Maplewood, N. J.

Harold F. Kneen, M.E. '25, M.M.E. '33, has resigned as vice-president in charge of manufac-

Harold F. Kneen

turing of Lincoln Electric Co., Cleveland, Ohio.

Robert P. Liversidge, M.E. '32, with Philadelphia Electric Co. since he graduated, has been promoted to manager of electric operations for the firm. He lives at 202 Clwyd Road, Bala-Cynwyd, Pa.

Victor K. Hendricks, Chem.E. '33, is supervising the construction of an oil refinery which Hydrocarbon Research, Inc., is building for "SACOR," the only refining company in Portugal. His headquarters are in Dusseldorf, Germany, where the major portion of the engineering work is being done, but some of his time is spent at the office in Lisbon. The work includes the construction of a lubricating oil plant, a TCC cracking unit, a gas recovery and gasoline treat-

(Continued on page 50)

Book Review

By PROF. CLYDE E. INGALLS

ELEMENTS OF TELEVISION SYSTEMS *by George E. Anner. Published in* 1951 *by Prentice-Hall Inc., Publishers, 70 Fifth Avenue, New York* 11, *N. Y.* 711 *pages.*

George E. Anner, assistant professor of electrical engineering at New York University, has chosen to write a book on one of the most popular subjects in modern communications. Books on television have gone through the stages of the presentation of elemental ideas and applications to the compilation of interesting circuits and methods of doing things in an orderly manner, using a sketchy theoretical background. These compilations have usually been strongly weighted in favor of the experience of a certain commercial concern working in the field. Often college courses are based on such books because of the sense of satisfaction to both instructor and students in the mastery of specific problems, particularly when these individuals are engineering or "application" minded.

Application books are very interesting and useful in the television field. However, they fall far short of the goal in education at the college level. George E. Anner's book is the first in the television field to attempt the teaching of basic principles and methods of problem attack as well as application, the tools of the engineer in creative thinking. Television is based on such a wide field of knowledge that it is impossible to try to cover in a reasonably priced book any but those basic principles and methods particularly useful in television and not likely to have been taught elsewhere.

Elements of Television Systems is aimed at the college level for use by upper-classmen and graduate students. The range of subjects includes the basis for television, scanning methods, scanning generators, scanning theory, camera tubes, video and high frequency band-pass amplifiers, synchronization, vestigial sideband transmission, transmitters, receivers, antennas, motion picture pickup, and color television.

Certain aspects are to be particularly commended. His approach to the subject of television in chapter one is refreshing, giving in a "nutshell" the reasons for the necessity of fooling the eye. Methods of fooling the eye are given in chapters two and eighteen, including some eye characteristics. The history of television is rightly ignored as being a waste of the student's time, but it is used in some cases as an aid to explanation. Three chapters devoted to scanning generators include the first serious attempt in a television text to treat the theory of scanning, including the distortion of aperatures and of the scanning process.

Definitions of illumination quantities, with which the communications engineer may be unfamiliar, are included in the chapter on television pickup devices. However, for some reason, consideration of picture tubes or kinescopes is lacking.

The reader will welcome a sizable section emphasizing the importance of noise in reception. A chapter on stagger-tuned circuits for band-pass amplifiers is quite complete. Vestigial sideband transmission is treated mathematically for the first time in a television text.

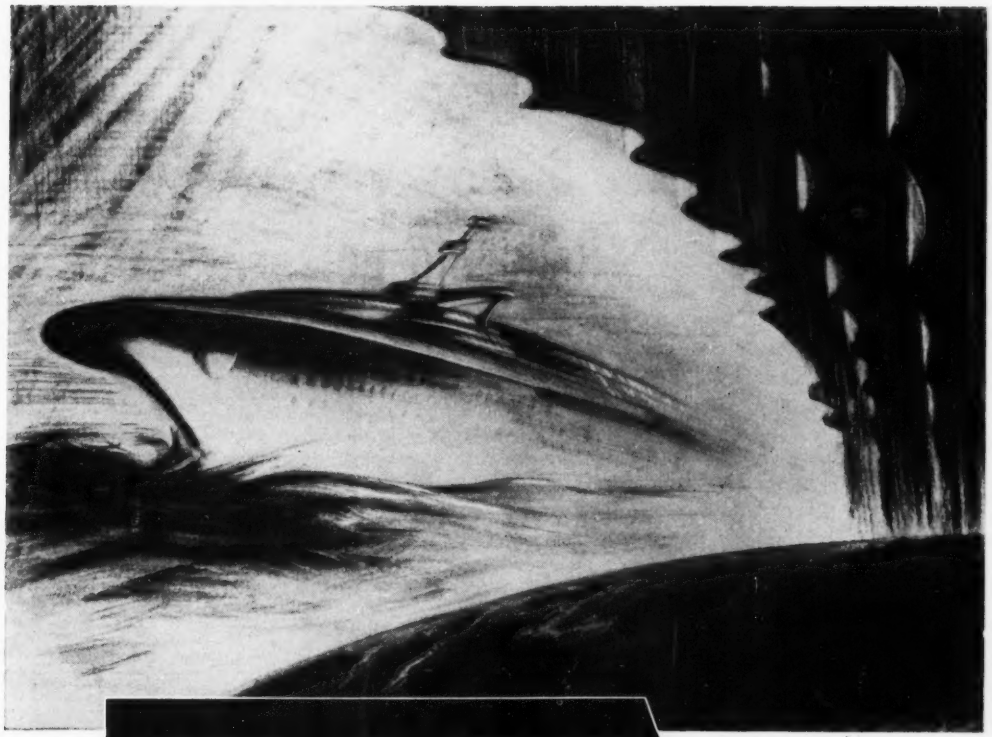
Color television and dot systems of television are treated in the last chapter and the appendix. These are quite good, but it is believed they were written after the rest of the books and were not given sufficient thought. The method of presenting color fundamentals, for instance, although correct and logical in sequence, is in such terms as to hide its significance.

A few other shortcomings might be mentioned. Certain illustrations are of definitely inferior quality, and additional illustrations at some points would greatly aid the text. An excellent opportunity to teach some information theory, which is needed in television, is largely passed over. The characteristics of the eye are not given sufficient attention for a good basis for creative work in television.

Video and high frequency band-pass amplifiers are presented principally on the steady state basis. More transient work should be included. The term "unit function," used in place of "unit step function" is somewhat confusing. A method of designing the important linear phase network is lacking. Only one facet of radio frequency amplification is given by limiting the discussion to stagger-tuned circuits. Similarly, the scope of vestigial sideband transmitters is limited to the type using a filter in the output and other available methods are not treated.

This book is definitely superior to its predecessors as a college text. Part of it is very interesting for casual reading, but parts of it need careful study and include mathematical aids to the student.

The reviewer is an Associate Professor of Electrical Engineering.



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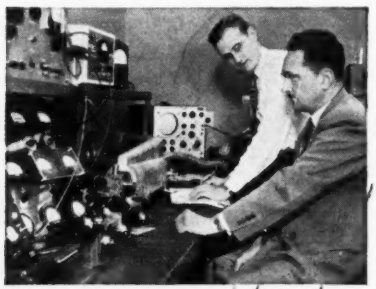
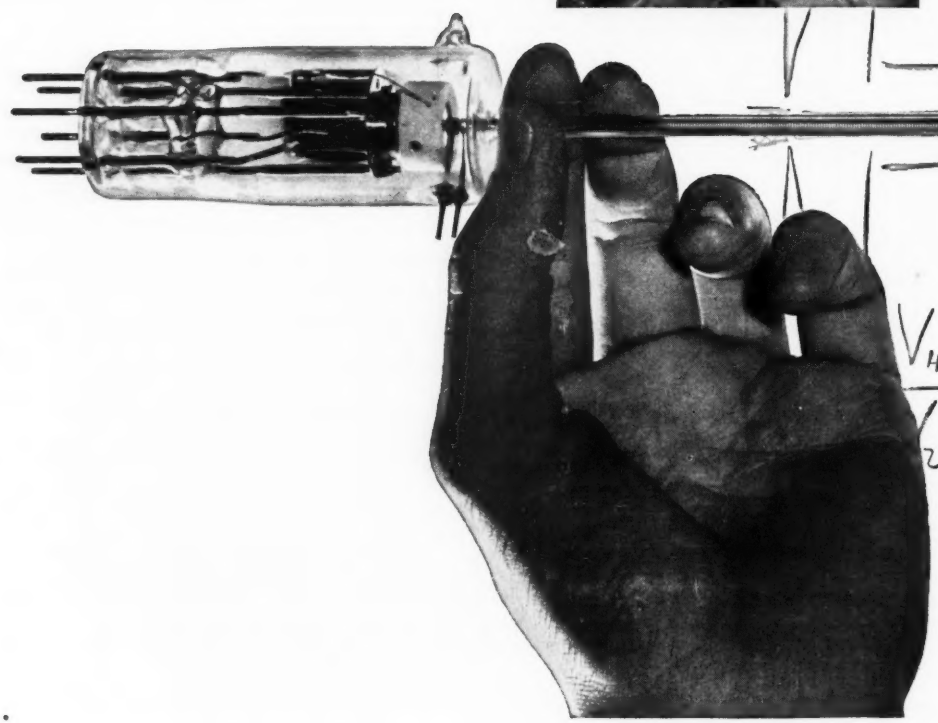
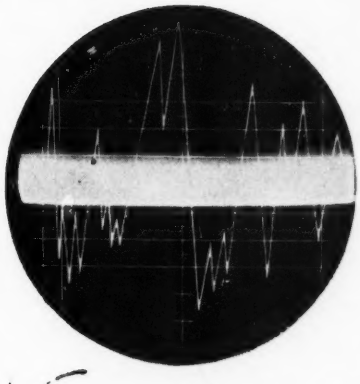
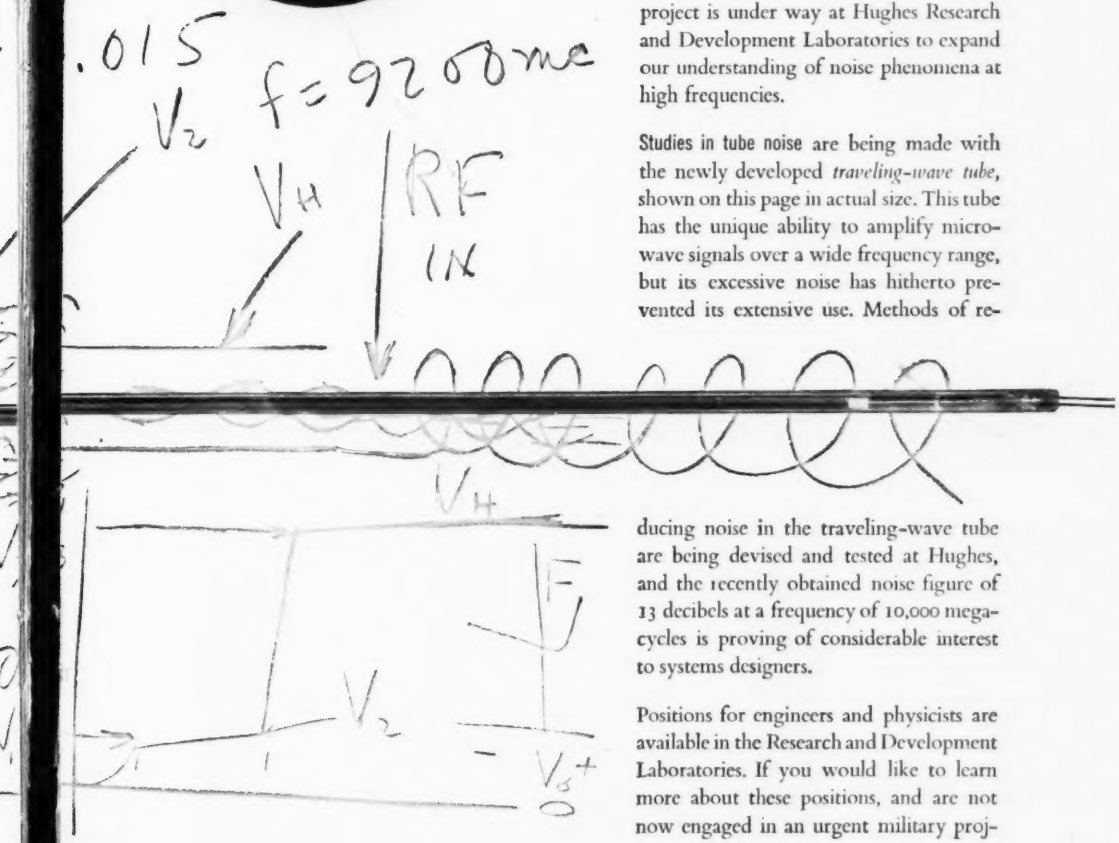
Reducing **noise** in radar...

Measuring the noise figure of an experimental traveling-wave tube are Dr. A. V. Haeff (right) head of the Electron Tube Laboratories at Hughes, and Dr. Dean Watkins (left) one of his co-workers.









In the operation of a radar system, the amount of energy reflected from small targets is very minute. The over-all sensitivity and range of radar depend equally upon effectively generating and transmitting considerable power at microwave frequencies—and upon effectively receiving and amplifying very weak echo signals.

An important limitation in receiver sensitivity is imposed by noise that is created within the receiving tubes—and caused by random motion of electrons. Because the reduction of tube noise could make available improved techniques to the designer of many types of microwave systems, a project is under way at Hughes Research and Development Laboratories to expand our understanding of noise phenomena at high frequencies.

Studies in tube noise are being made with the newly developed *traveling-wave tube*, shown on this page in actual size. This tube has the unique ability to amplify microwave signals over a wide frequency range, but its excessive noise has hitherto prevented its extensive use. Methods of reducing noise in the traveling-wave tube are being devised and tested at Hughes, and the recently obtained noise figure of 13 decibels at a frequency of 10,000 megacycles is proving of considerable interest to systems designers.

Positions for engineers and physicists are available in the Research and Development Laboratories. If you would like to learn more about these positions, and are not now engaged in an urgent military project, write to:

Hughes Research and Development Laboratories
Engineering Personnel Department
Los Angeles County
Culver City, California

Technibriefs

Brookhaven Cosmotron

The Brookhaven Cosmotron, now undergoing testing and evaluation, was viewed by approximately 1000 students and other guests when Brookhaven National Laboratory held its annual Visitor's Day last spring. The Cosmotron is designed to speed protons to an energy exceeding two billion electron volts, or five times that of the most powerful existing accelerators. These protons (nuclei of hydrogen atoms) will strike various targets, including copper and hydrogen. Collisions at such energies are expected to produce mesons, the newly found array of short-lived particles which appear in cosmic rays and seem to hold the key to nuclear forces.

Brookhaven is the northeastern center for nuclear research and development operated under contract with the U.S. Atomic Energy Commission by Associated Universities, Inc., a non-profit, educational corporation sponsored by nine eastern universities.

Aircraft Locater

Keeping the pilot informed of his plane's position is the purpose of the pictorial computer developed by the Arma Corporation of Brooklyn. The device automatically calculates a plane's distance and direction from a known point of radio transmission on the ground below. The manufacturers claim accuracies for range of ± .4 miles, for bearing ± .5 degree and for heading ± 1 degree.

The computer is used in conjunction with the Omni-Bearing Distance System, simply by selecting the right chart and keeping the plane headed toward its destination. The computer indicates the aircraft's position and heading in relation to the chart on the screen.

The display unit consists of a chart, which is part of a 35mm film roll, mounted behind a 10-inch screen. At the center of the chart is an omni-bearing distance center (OBD), which is the point from which the computer calculates heading and position. Aircraft position is indicated on the chart as the center of concentric range circles and radiating bearing lines. The plane's heading is designated by a symbol of a plane as well as by a series of arrows passing through the aircraft position.

Each film strip contains the necessary number of charts between the two terminal cities of the particular flight. Seven hundred rolls can be stored in the display unit. A system of call letters and indexing facilitates finding the correct chart, while a motor drives the film at speeds up to ten charts per second.

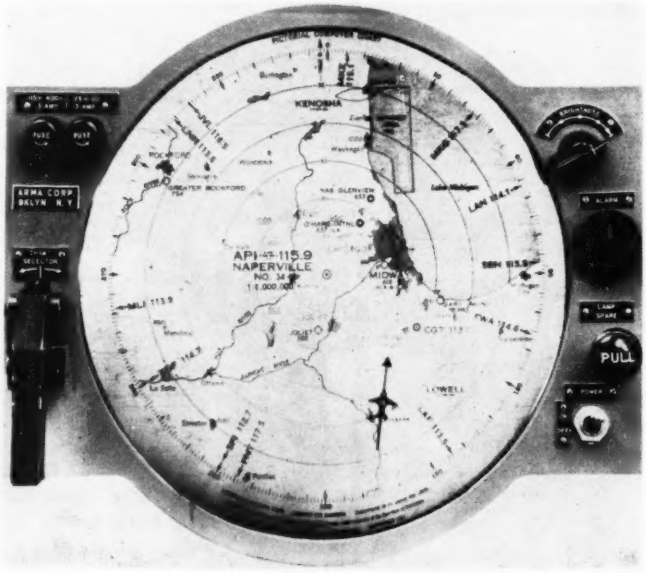
The pictorial computer is completely automatic, except for the chart selection and for certain initial adjustments. It consists of two units, the display unit and the amplifier. The former is mounted on the instrument panel in the cockpit, while the latter is set in the communications rack. Both occupy a small area and are light in weight.

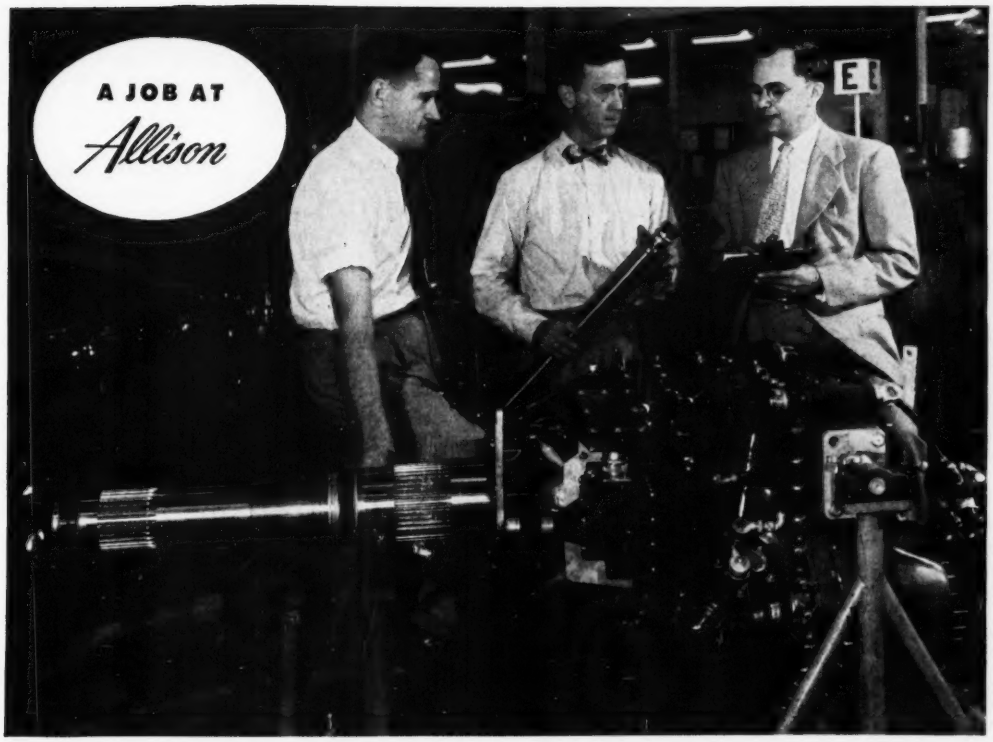
Static Electricity

The National Bureau of Standards recently published a report on the behavior and danger of static electricity. Also included were recommendations for the control of this potential killer and its effects in hospitals, industries and on equipment.

Static electricity is both useful

Front view of the aircraft locator showing the position and bearing of the aircraft. —Arma





Left to right—C. Mead Hawkins, U. of Toledo, B.S., Mechanical Engineering 1948, M. H. Thomas, Kansas State College, B.S., Mechanical Engineering 1939 and V. W. Peterson, B.S., Mechanical Engineering, Rose Polytechnic Institute.

● V. W. (Pete) Peterson, who was graduated from Rose Polytechnic Institute in 1939, is one of the modern day pioneers in the design of jet and turbo prop engines. His particular job is to supervise a group of engineers responsible for the basic detail design of reduction gear boxes and extension shaft systems for Allison Turbo-Prop Aircraft Engines.

Each engine consists of a pair of turbine power sections which revolve at more than 14,000 r.p.m. Two extension shafts transmit this high rotative speed to a gear box which reduces the shaft speed in the order of 16 to 1 to drive two contra-rotating co-axial propellers. Some airplane installations require extension shafts as much as 14 feet long. Thus, the problem is more than harnessing the engine output of 5500 horsepower to a propeller. The long shafts, rotating at high speeds, must be delicately balanced with flexible bearing mounts so they will not set up destructive vibration even though they are subject to many kinds of bending and twisting motions through various attitudes of flight.

This is another of the interesting problems at Allison which represent a challenge and an opportunity for young engineers. Every day men at Allison are making a new contribution to the science of jet engines. And, at the same time they are adding to their own experience in a field which offers life-time careers for qualified young men.

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Technibriefs

(*Continued from page 36*)

and destructive. It is used beneficially in ore separation and paint spraying processes, whereas in such industries as explosive manufacturing,' grain storage, and textiles, it is a distinct hazard. In a granary, for example, the air is usually filled with fine flammable particles of grain. When grain is sliding down a metal chute, the static charge produced can easily ignite the small particles and cause an expensive fire.

Special emphasis was given in the report to the making of conductive floors to carry away the charge. It is the natural inclination of the charges to rapidly reunite that causes the spark or provokes the shock and results in a dangerous position. A floor having a resistance of one million ohms or less is suitable to prevent this rapid reuniting and the resulting danger.

Flooring was tested by subjecting it to different voltages under various conditions of temperature and humidity. A section of terrazzo flooring, tested between the ranges of 30-500 volts, showed a corresponding resistance from 4.5-1.5 megohms. But a low resistance flooring, linoleum, changed from 3 megohms at 40 volts to less than 10,000 ohms at 150 volts.

The voltages attained by static electric charges are amazingly large. Such every-day practices as getting up from a plastic covered chair can produce some 5000 volts. If the resistance between person and chair is less than 20 megohms, the resulting voltage will not exceed the minimum sparking voltage and hence is not dangerous.

Many accidents are caused indirectly by static electricity. For instance, when a person receives a shock from touching a conducting object, he is usually merely annoyed. However, if this same jolt were administered to someone on the top of a ladder, serious damage could result. Also, the energies of electrostatic sparks may be large enough to ignite flammable vapors or gases in an enclosed room.

The prevention of the violent reuniting of the charges is the basis on which scientists have worked to do away with the dangers of static electricity. These preventive measures include common grounding of metal objects, humidification, and installation of conductive flooring. Humidification coats most objects with a thin conductive film of moisture, while conductive flooring mitigates the dangers caused by friction between the floor and moving objects or persons.

150-Pound Turbine

Delivering 84 shaft horsepower, yet weighing only 150 pounds and small enough to fit into a car's luggage compartment, a powerful tiny turbine has been designed and manufactured by AiRsearch. It has been adapted especially to aircraft use, but its potentialities are unlimited.

Jet planes, which require 40

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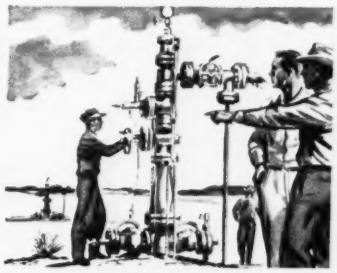

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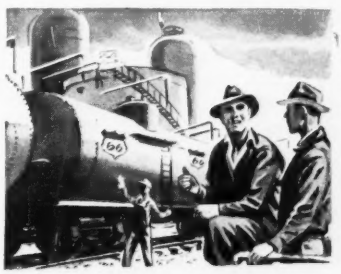

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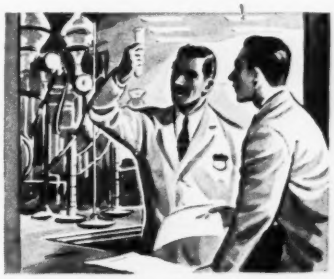

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Technibriefs

(*Continued from page 38*)

times the amount of cranking force needed by propeller-driven craft, have made use of this mighty midget. In addition to its pneumatic starting operations for these jets, the turbine can also be utilized for operating other aircraft accessories as well.

In the pneumatic system, the small gas turbine starts jet engines in combination with an air turbine starter. The gas turbine sends compressed air to the air starter, giving the starter wheel speeds up to 30,000 r.p.m. By means of reduction gearing, power taken from the wheel is used to crank up the main engine. A slightly altered model of the gas turbine supplies power directly through a shaft to an electrical alternator, which produces enough electricity to operate the plane's accessories.

In order to obtain a great deal of power from such a small turbine, high speeds and temperature, are necessary. The problem of finding a material which could stand the 1600°F. temperature and the 40,000 r.p.m. speed without expanding against the casing was a serious one. After trying various tungsten, chrome and cobalt steel alloys, the manufacturers made use of a nickel alloy developed by International Nickel, which has a low creep rate under heavy stress at high temperatures.

TV Freeze Lifted

After four years of a ban on construction of new television stations, the Federal Communications Commission has lifted the freeze. This will enable some 500 new stations to be built, which, along with the existing 108, will fill that part of the radio spectrum from 54-216 megacycles.

At present, seventy new channels have been authorized on the new UHF band between 470-870 megacycles. This range has space for some 1,445 new stations. The addition of these UHF stations to the conventional VHF (very-high frequency) ones will give the U.S. and its possessions a total of over 2,050 TV stations in 1,291 communities.

UHF is not a new discovery by any means. Hertz used them in producing electromagnetic waves. Their disadvantage, as is the case with VHF, is that short wave lengths prevent them from carrying great distances. The effective serviceable range is around 50 miles. Wave lengths of existing stations average about 15-20 feet, whereas a wave in UHF may run as short as 13 inches. Marconi, in sending his wireless message across the Atlantic, used wave lengths 1000 meters long. Modern wave measurements are in kilocycles or megacycles; VHF runs from 30-700 megacycles and UHF from 300-3000 megacycles. Radio runs from about 550-1700 kilocycles.

Extensive tests by RCA and NBC have shown four advantageous effects of UHF broadcasting. First, in regard to reception, UHF is an improvement over VHF in that auto ignitions, neon signs, or

(*Continued on page 44*)

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This huge new building pictured above is one of the world's most modern petroleum research laboratories—those of the Standard Oil Development Company at Linden, N. J. It is the research center where Esso Products are constantly developed and improved by engineers and technicians whose aim is better products for better living all over the world.

Here chemists and engineers find limitless opportunities for the scientific advancement of petroleum research. Scientific exploration in all the phases of oil production is constantly encouraged at Esso.

The 28,000 workers at Esso have been with the company an average of over 14 years . . . 8,600 of them for 20 years or more. Esso is proud to have this large number of long service employees, enjoying fair pay, good working conditions, and a chance to learn more about the oil business and to advance in the company.

It has been an Esso Management policy for more than 30 years to keep *good people* happy at *good jobs* . . . and turn out consistently *good products* that carry the Esso trade-mark.

Esso

ESSO STANDARD OIL COMPANY

New RCA Victor record changer —easiest to play at all three speeds!

THE CENTER IS THE SECRET:
Just slip on the large center spindle to play "45" records *automatically*. Slip it off, and play records at other speeds.
Permanent spindle and changer play stacks of 33⅓ or 78 rpm records automatically.
A flick of the finger and you have the right needle to play 45, 33⅓, or 78 rpm records.
Fingertip control of speeds (78, 33⅓, 45) and one control for *On*, *Off*, or *Reject*.

World's simplest 3-speed changer, this versatile Victrola combines new playing ease with the finest reproduction of sound. And it changes "45" rpm records *correctly*, on the same turntable used for other speeds.

Key to this advance is RCA Victor's *slip-on* "45" spindle, which fits over the permanent spindle and locks in place. No plugs or extra gadgets. Simply stack your "45" records on this fine instrument, and play up to fourteen of them—at the twist of a knob. Then, whenever you wish, remove the "45" spindle, flick the needle and speed controls, and the same Victrola changer will play records automatically at 33⅓ or 78 rpm.

More than a year of research and engineering went into this changer—further evidence of the leadership which assures you finer performance in any product or service of RCA and RCA Victor.

* * *

See the latest in radio, television, electronics at RCA Exhibition Hall, 36 West 49th St., N. Y. Admission is free. Radio Corporation of America, RCA Building, Radio City, New York 20, N. Y. Tmks. ®

RADIO CORPORATION OF AMERICA

World leader in radio—first in television

CONTINUE YOUR EDUCATION WITH PAY—AT RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short-wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to College Relations Division, RCA Victor, Camden, New Jersey. **Also many opportunities for Mechanical and Chemical Engineers and Physicists.**

Remove 4 Bolts . . .

and there's the impeller!

MORRIS
Type R
SLURRY
PUMP

No need to disconnect the piping!

Morris Type R is the slurry pump whose impeller can be removed without disturbing the suction and discharge piping or the bearings! To get at the impeller and renewable shaft sleeve, you simply loosen four outside clamping bolts — slip them out of disc slots — take off the end cover. Impeller unscrews from shaft threads; shaft sleeve is removed through end cover opening.

At no point do you have to dismantle the piping. Lay-up time costs are less . . . pump is back in service quicker.

Use the Morris Type R in Your Chemical Operations

Morris Type R is the product of 88 years' experience in designing and building materials-handling pumps. It is specifically engineered to handle mixtures containing abrasive solids and chemicals in suspension, including acid slurries and sludges and slurries containing soda ash, ore concentrates, tailings, slag, etc.

Write for specifications, capacities, performance charts, and other helpful information. Ask for Bulletin 181.

MORRIS MACHINE WORKS
Baldwinsville, N. Y.
Branch Offices in Principal Cities

MORRIS Centrifugal Pumps

Technibriefs

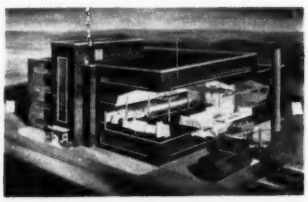
(*Continued from page* 40)

household appliances do not bother it. Second, present TV sets can be equipped with selectors to increase the range of reception. Third, the cost of a UHF station is about the same as for a VHF unit; and finally, color TV can also be broadcast on UHF.

$6,000,000 Lab

Construction has started on a $6 million steam and gas turbine development laboratory at the South Philadelphia Works of the Westinghouse Electric Corporation. The four-story, brick and structural steel building will take about a year to complete. It will employ a staff of nearly 100 engineers and technicians and initially will conduct special research for the U.S. Air Force.

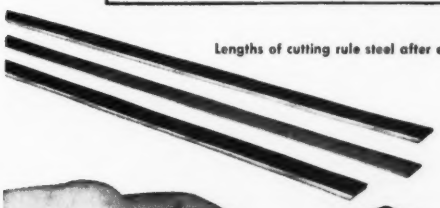
The new research center is to be the most modern engineering development laboratory of its kind in the nation. Steam and gas turbines



and their components up to 15,000-kilowatt capacity will be accommodated in the main test hall of the new research building. Three 8,000-horsepower axial-flow compressors will provide facilities for compressor development for gas turbines and the Air Force wind tunnel. Separate laboratories will be provided for hydraulic, heat exchange, mechanical, aero-dynamic, combustion, and model shop activities. The laboratory powerhouse will include a huge boiler providing 150,000 pounds of steam per hour at a temperature of 900 degrees, F. A reheater at the laboratory, used in conjunction with reducing valves, will make available steam at any desired pressure up to 1500 pounds per square inch and at temperatures ranging from 800 to 1100 °F.

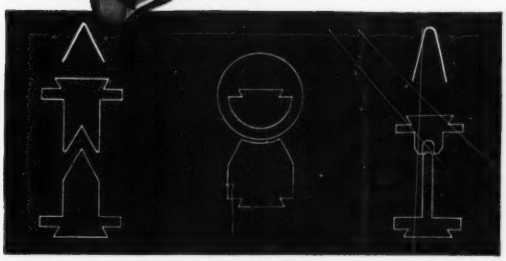
What's Happening at CRUCIBLE

about scoring and cutting rule steel



Lengths of cutting rule steel after edging

Shaped to cut wallet section (note bends, and form-holding method)



Some examples of the many shapes of bends needed

Scoring and cutting rule steel is a cold-rolled specialty steel for use in preparing dies for cutting paper, leather, rubber and other materials.

It is a pre-tempered product manufactured by skilled workmen, using precision rolling and hardening equipment, to close limits for chemistry, grain size and hardness. This product must also be capable of meeting intricate bend requirements in the hardened and tempered condition.

This specialty is furnished with round edges and in coil form to the rule manufacturer who grinds the edges — the one edge square and the other to a knife edge as well as cutting the material into desired lengths. This is sold to a die-maker who bends the rule to the required shape. This is then the nucleus of a pre-hardened die, which when properly brazed and supported is used to cut out material for display cards — aircraft parts — pocketbooks — wallets — gloves — gaskets — washers.

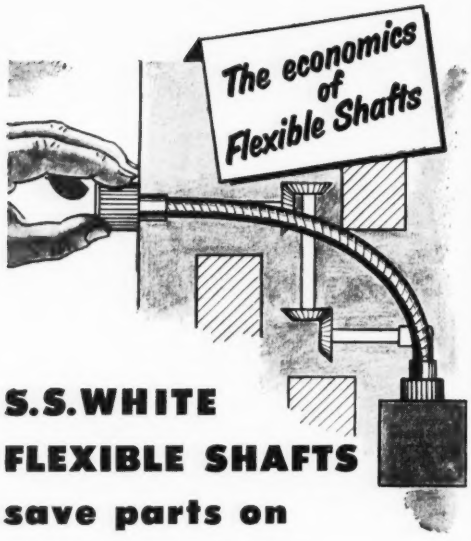
engineering service available

Since there is a great diversity of cold-rolled products, our staff of field metallurgists can help you apply what you require. Take full advantage of Crucible's more than 50 years experience as the first name in special purpose steels. Crucible Steel Company of America, General Sales and Operating Offices, Oliver Building, Pittsburgh, Pa.

CRUCIBLE first name in special purpose steels

52 years of Fine steelmaking

Midland Works, Midland, Pa. • Spaulding Works, Harrison, N. J. • Park Works, Pittsburgh, Pa. • Spring Works, Pittsburgh, Pa.
National Drawn Works, East Liverpool, Ohio • Sanderson-Halcomb Works, Syracuse, N. Y. • Trent Tube Company, East Troy, Wisconsin



S.S.WHITE FLEXIBLE SHAFTS save parts on remote control applications

Just compare the simplicity of the flexible shaft control, shown above, with the combination of rods, bevel gears, pulleys and belts that might otherwise be necessary. The savings in parts and costs are obvious. What's more the flexible shaft is less complicated, needs no alignment; is easier to install and gives more freedom in mounting the coupled parts where desired to assure better and more convenient operation.

• • •

Many of the problems you'll face in industry will deal with the application of power drive and remote control with cost being an essential factor. That's why it will pay you to become familiar with S.S.White Flexible Shafts, because these "Metal Muscles"® offer important savings in transmitting power or control.

SEND FOR THIS FREE FLEXIBLE SHAFT BOOKLET

Bulletin 5008 contains basic flexible shaft facts and shows how to select and apply flexible shafts. Write for a copy.

THE S.S.White INDUSTRIAL DIVISION
DENTAL MFG. CO. Dept. C, 10 East 40th St. NEW YORK 16, N. Y.

New No. 4 AUTOMATIC Screw Machine

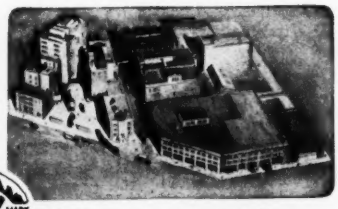
. . . for low-cost, medium sized Screw Machine Work

Modern in design, massive in construction, assures continuous, accurate production of medium size parts for cameras, automobiles, business machines, time fuses, etc. Wide range of speeds and high-to-low speed ratios, (168 two-speed combinations from 17 to 1965 R.P.M. in ratios from 2.2:1 to 13:1) make possible highest cutting efficiency on a wide variety of materials and work diameters.

Write for illustrated bulletin on the new No. 4 Automatic. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

BROWN & SHARPE BS

Philadelphia's Largest Brewery Uses 2300 Horsepower of



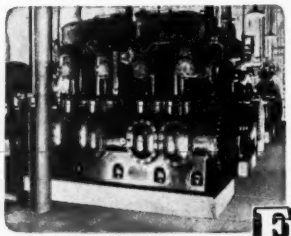
FRICK Refrigeration

C. Schmidt and Sons, Inc., founded in 1860, now make over a million barrels of beer and ale annually in their plant on Edward Street.

A pair of Frick four-cylinder ammonia compressors was installed at Schmidts' twelve years ago. Today this battery includes six machines, the largest with motors of 450 hp. each.

For dependability, stick to Frick Refrigeration.

The Frick Graduate Training Course in Refrigeration and Air Conditioning, operated over 30 years, offers a career in a growing industry.



Six Big Frick Compressors at C. Schmidt and Sons' Brewery

FRICK CO. WAYNESBORO, PENNA. U.S.A.
Also Builders of Power Farming and Sawmill Machinery

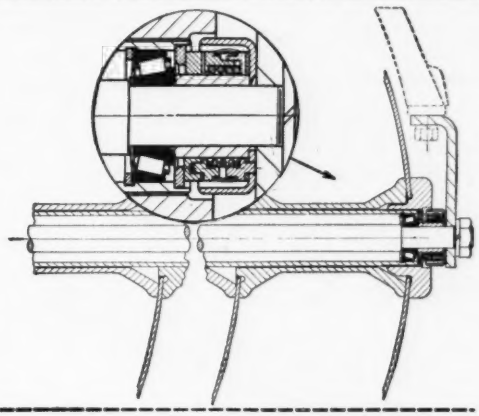
Another page for **YOUR BEARING NOTEBOOK**

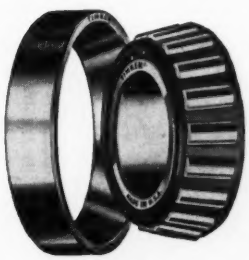
How agricultural engineers solve 3 design problems at once

Designing farm machinery applications like the through shafts of disk harrows presents three big problems to agricultural engineers: 1) combination loads, 2) dirt, 3) ease of operation. Engineers solve all three problems at once by designing the shafts on Timken® tapered roller bearings. Because they are tapered, Timken bearings carry both radial and thrust loads in any combination. They keep housings and shafts concentric, making closures more effective. Dirt stays out—lubricant in. And they keep shafts turning easily because of their true rolling motion and incredibly smooth surface finish.

How to mount disk harrow shafts on TIMKEN® bearings

Two single-row Type TS Timken bearings are indirectly mounted on a stationary shaft in a rotating disk assembly. The bearing cups are press-fitted against snap rings. The bearings are adjusted by means of shims between the bearing cone and shaft shoulder. A special spring-backed rubbing seal assures maximum protection to the bearings. The rubbing seal itself is protected by a shield fitted about the closure assembly.





TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

How to learn more about bearings

Some of the engineering problems you'll face after graduation will involve bearing applications. If you'd like to learn more about this phase of engineering, we'll be glad to help. For a copy of the 270-page General Information Manual on Timken bearings, write today to The Timken Roller Bearing Company, Canton 6, Ohio. And don't forget to clip this page for future reference.

NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL ⬮ AND THRUST —⬮— LOADS OR ANY COMBINATION ✳

LAVA

Manufacturers of Super-Refractories Only

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REFRACTORY CRUCIBLES
GRAPHITE CRUCIBLES
HIGH-TEMPERATURE CEMENTS
SPECIAL REFRACTORY BRICK, TILE, SHAPES

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From the Following Materials:—

GRAPHITE **SILICON CARBIDE** —— **FUSED ALUMINA** —— **MULLITE**
MAGNESIA **ZIRCON**

◇

LAVA CRUCIBLE-REFRACTORIES CO.
PITTSBURGH, PA.

BETTER MEASURE WITH LUFKIN

The thousands upon thousands of men who use precision tools will tell you that there are none better than Lufkin. All Lufkin precision tools are the product of years of fine tool-making experience combined with the very latest design features. Experienced engineers know Lufkin tools are the most accurate they can buy. See the complete line of Lufkin tapes, rules, and precision tools at your hardware or tool store.

BUY LUFKIN TAPES • RULES • PRECISION TOOLS
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THE LUFKIN RULE CO., SAGINAW, MICH. 198
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THE LUFKIN RULE CO., Saginaw, Michigan
Please send me the interesting illustrated booklet, "Micrometer Reading Made Easy!"

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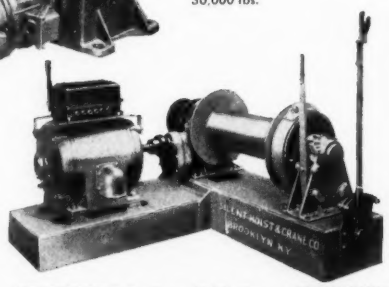
CAR PULLERS, BARGE MOVERS
ELECTRIC, GASOLINE, DIESEL

Let ***Silent Hoist*** Car Pullers, electric, gasoline, and diesel driven Winches serve you. Power-driven Capstans, Gypsies, and single and double Winches for all materials-handling applications — rigging, skip hoists, maintenance, construction, cable ways, etc.

CAPSTAN *6 Sizes:* Draw Bar Pull	DRUM WINCH *4 Sizes:* Capacities
2,000 lbs.	6,000 lbs.
6,000 lbs.	12,000 lbs.
12,000 lbs.	24,000 lbs.
18,000 lbs.	40,000 lbs.
22,000 lbs.	
30,000 lbs.	



Mfrs. of ***KRANE KAR*** *Swing-Boom Mobile Cranes,* ***LIFT-O-KRANE*** *Fork Lift Trucks, Cranes for Motor Trucks, Capstans, Gypsies, Single and Double Drum Winches, Coal Slicer Hoists.*

SILENT HOIST & CRANE CO.

874 63 St. Brooklyn 20, N. Y.

how large?

The 40- to 75-foot trademarks of a world-famous Thanksgiving Day parade are inflated with helium. Lighter-than-air, this "safe" gas will not burn or explode.

how small?

From the eye-bright yellow "Mae West" to the life-saving raft of an Air Force pilot, CO_2, one of the family of Airco gases adds to the safety of American airmen everywhere.

at the frontiers of progress you'll find

AN AIR REDUCTION PRODUCT

Big as a balloon . . . small as cartridge ampule, the range for needed gases is only one segment of the innumerable operations that link the Airco corporate family to many basic activities of American life – and industry . . . a corporate family that depends upon each individual member for its strength.

What is the strength behind Airco? – air and its constituent gases, plus the wide range of companion products that contribute to the comfort and convenience of daily life . . . from anesthesia to aircraft construction . . . from plastics to shipbuilding. In fact, wherever progress is racing ahead to new frontiers, you'll find an Air Reduction product.

AIRCO® **AIR REDUCTION COMPANY, INCORPORATED**
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Divisions of Air Reduction Company, Incorporated,
AIR REDUCTION SALES COMPANY, AIR REDUCTION PACIFIC COMPANY, AIR REDUCTION MAGNOLIA COMPANY... *Industrial Gases, Welding and Cutting Equipment* • AIRCO EQUIPMENT MANUFACTURING DIVISION • NATIONAL CARBIDE COMPANY... *Calcium Carbide* • OHIO CHEMICAL & SURGICAL EQUIPMENT CO., OHIO CHEMICAL PACIFIC COMPANY... *Medical Gases – Apparatus – Hospital Equipment* • PURE CARBONIC COMPANY ... *Carbonic Gas and "Dry-Ice"* • AIRCO COMPANY INTERNATIONAL... *Export* • AIR REDUCTION CHEMICAL COMPANY

Alumni News

(Continued from page 21)

ing unit, and a catalytic polymerization unit, together with a power house, steam generating plant, water-cooling system, and waste-disposal system. His family is with him in Dusseldorf, where he may be addressed in care of Hydrocarbon Mineralol, GMBH, 15-17 Furstenwall.

Edgar H. Bleckwell, M.E. '33, has been promoted to technical manager of the nylon division of E. I. du Pont de Nemours & Co. in Wilmington, Del. He has been manager of their nylon plant in Chattanooga, Tenn.

Charles F. Boschen, Chem.E. '37, is chemical supervisor at the Du-Pont Chamber Works in Deepwater, N. J. He lives at 13 Maplewood Avenue, Penns Grove, N. J.

George F. Carrier, M.E. '39, PhD '44, has been appointed Gordon McKay Professor of Mechanical Engineering and head of the department of mechanical engineering at Harvard. Son of Charles M. Carrier '16, he was instructor in Machine Design at Cornell in 1943-44; he became assistant professor of engineering at Brown University, Providence, R. I., in 1946 and professor in 1948.

James R. Donnalley, Jr., Ph.D. in Chem.E. '44, was recently promoted to manager of manufacturing for the silicone products department of General Electric Co. at Waterford. He lives on Hedgewood Lane, R.D. 1, Schenectady, N. Y.

Pierre Yakovleff, Chem.E. '44, married Phyllis Stewart of New Zealand. He is French representative for Blaw-Knox Co. at 11 Rue La Boettie, Paris, France.

Laurence Aquadro, M.E. '47, married Miss Anne Klutey of Wilmington, Delaware, on May 10, 1952. Mr. Aquadro is associated with the Du Pont Company's Textile Fibers Customer Service Division. The couple's new address is 3906 Sussex Drive, Apt. A, Lancaster Court Apts., Wilmington, Delaware.

Pfc. Jose Safdeye, B.S. in A.E. '48 is an instructor at the Ordnance School at Aberdeen Proving Ground, Md. His address is Box 317, Co. B, T.O.S., Aberdeen Proving Ground, Md.

Lee Fraser, M.E. '26, has been promoted to Production Manager of the Arma Corporation of Brooklyn and Mineola, N. Y., subsidiary of the American Bosh Corporation. Previous to his new appointment, Mr. Fraser had many years of production experience in the United States, Europe, and South America with the Western

Lee Fraser

Electric and International Standard Electric Corporation. Mr. Fraser's home is at 116 East 68th Street, New York City.

Walter L. Brenholtz, B.Chem.E. '49, has been made field engineer of Blaw-Knox Co., Pittsburgh, Pa., and assigned to the supervision of construction and the starting of several new plants in the Midwest and Southwest. His address is 306 Biddle Avenue, Pittsburgh 21.

Joseph S. Gottlieb, B.S. in C.E. '49, is assistant superintendent and sales representative of Pennsteel Corp., processors of industrial scrap iron and steel, and assistant secretary of Linda Coal Co. He lives in Schenley Apartments, 4000 Fifth Avenue, Pittsburgh, Pa.

Peter Harriott, Chem.E. '49, since completing work for his Sc.D. in chemical engineering at M.I.T., has been with the process development section of the General Electric silicone plant in Waterford. His address is 464 Main Street, Hanson, Mass.

Charles C. Peterson, E.P. '51, has received a fellowship from the Radio Corporation of America for graduate work in the Department of Engineering Physics. His fellowship, one of eight granted to young engineering graduates throughout the country, was awarded on the basis of "outstanding ability in the fields of study related to radio, television, and electronics." While pursuing his undergraduate studies, Mr. Peterson was on the Dean's List for nine terms. His home address is 42 Oakland Place, Summit, N. J.

Lt. Owen H. Griffith, B.M.E. '51, is now stationed with the 411th Signal Radio Relay Co., Signal Corps Training Center, Camp Gordon, Georgia. Before entering the service, he was employed by the Sperry Gyroscope Company of Great Neck, Long Island. His home address is 2803 Louden Ave., Baltimore.

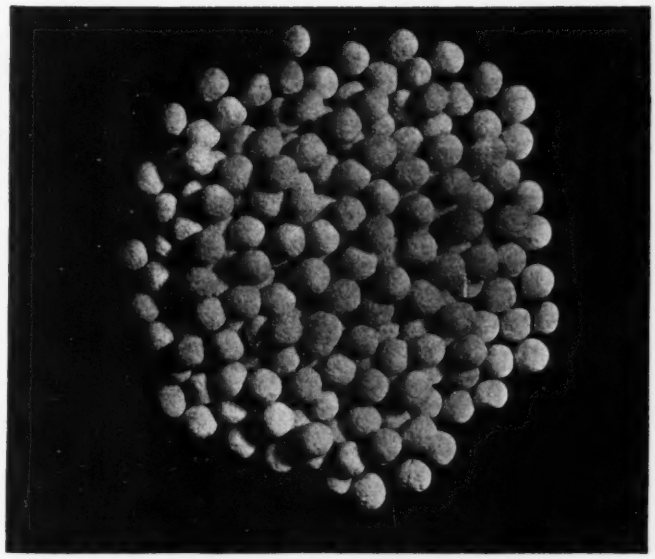
A Fulbright grant for foreign study during 1952-53 was awarded to **Charles D. Graham, Jr.,** of Dayton, Ohio, who graduated from the five-year metallurgical engineering course at Cornell last spring.

He is using the grant for advanced study in physical metallurgy at the University of Birmingham, in England. He expected to go to England about Oct. 1, after spending the summer in work at the General Electric research laboratories in Schenectady.

A dean's list student in the School of Chemical and Metallurgical Engineering, Graham was editor of the Cornell Daily Sun in 1950-51. He is married to the former Alison Bliss of Ithaca.

What Are These Spheres?

- ☐ *Catalyst Supports*
- ☐ *Moth Balls*
- ☐ *Abrasive Grains*



They are catalyst supports — Norton refractory products made of chemically inert, heat-resistant, wear-resistant materials for use as catalytic carriers in chemical processes. Pictured in spherical shape here, they are also available as pellets and rings.

Composition and Properties

These supports are commercially available in ALUNDUM* (fused alpha alumina) mixtures varying from 77% to 89% alumina with silica as the principal impurity. In addition to their refractoriness, they are chemically inert, mechanically strong and wear-resistant.

Water absorption values of these supports vary from 12% to 22% by weight. Surface areas by the nitrogen absorption method range up to about one square meter per gram. Crushing strengths vary from 20 to 600 pounds, depending on size and shape, and bulk densities range from 60 to 80 pounds per cubic foot.

Many Refractory Products

Catalyst supports are but one of many refractory products made by Norton. These include small furnace refractories such as tubes, cores and muffles; large furnace refractories such as bricks, plates, muffles and other shapes; refractory cements; refractory laboratory ware; kiln furniture for ceramic plants.

In its search for refractory products that can be used at higher and higher temperatures, Norton has developed a line of pure oxide refractories. These refractory shapes, as their name implies, are molded without bond and then fired at sufficiently high temperatures to produce a truly sintered product.

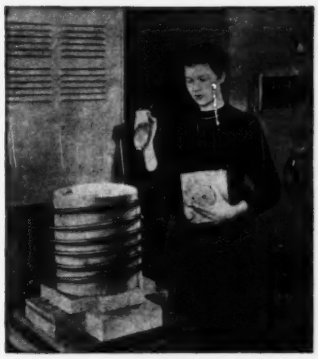
The principal raw materials used in the manufacture of Norton pure oxide refractories are ALUNDUM (fused alumina), MAGNORITE* (fused magnesia), fused stabilized ZIRCONIA and, to a limited degree, fused thoria.

Planning Your Future?

Norton Research is continually developing better products to make other products better. Young technicians who are interested in contributing to the technical advances of the future will find Norton Research well worth investigating.

Free Booklet on

longer lasting Norton refractory products contains detailed descriptions of Norton contributions in this field. Write for your copy.



Norma L. Gullberg, A.B., Chemistry, Clark University '46, takes a reading with an optical pyrometer on a high temperature furnace used for catalyst support tests.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

NORTON

TRADE MARK REG. U. S. PAT. OFF.

Making better products to make other products better

ABRASIVES · GRINDING WHEELS · OILSTONES · ABRASIVE PAPER & CLOTH

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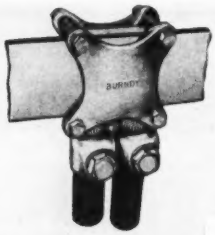
NORTON COMPANY, WORCESTER 6, MASSACHUSETTS

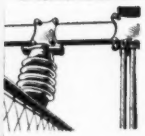
BEHR-MANNING, TROY, N. Y. IS A DIVISION OF NORTON COMPANY

PROBLEM: To join or terminate any electrical conductor— anywhere

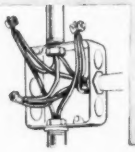
SOLUTION: BURNDY CONNECTORS

Wherever electrical conductors are joined, terminated, clamped or grounded —you'll find Burndy connectors completing the circuit . . . safeguarding the circuit. Right down the line, from mammoth industrial or utility installations to house service drops . . . from B-36's to washing machines Burndy connectors are included in the most exacting engineering specifications. Wherever your job takes you, you'll find Burndy connectors on the job, too. Here are just a few examples of Burndy-engineered connectors:





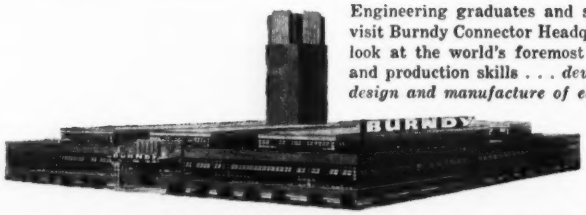
BURNDY BARTAP
Burndy has developed a complete line of heavy-duty connectors—standard and special shapes—of high current capacity. Used in utility substations, industrial power houses, hydro-electric projects, etc.



BURNDY SERVIT
Most versatile, efficient and popular split-bolt connector for splices, taps, dead-ends. Used and re-used for sizes #12 Str. to 1000 Mcm. Variations available for aluminum and steel conductors, and for combinations of these and copper.

BURNDY HYSPLICE
These compression splices, installed by Burndy hydraulic tools, are used in power transmission lines, where joints require maximum conductivity, highest mechanical strength.

BURNDY HYLUG
Solderless connector of one-piece, pure copper construction—with longitudinal indent method of installation. Adaptable to economical mass-production, used in thousands of plants manufacturing electrical equipment. *A Burndy exclusive.*



Engineering graduates and students are invited to visit Burndy Connector Headquarters for a first-hand look at the world's foremost research, engineering, and production skills . . . *devoted exclusively to the design and manufacture of electrical connectors.*

52-25 **BURNDY ENGINEERING COMPANY INC.,** NORWALK, CONNECT. **BURNDY CANADA LTD.,** TORONTO 8, ONT.

Easy way to get rich

SUPPOSE, as you enter a grocery store, you suddenly find the denomination of every bill in your pocket has doubled! You're rich! Until you find that the same "magic" has doubled the price of everything in the store.

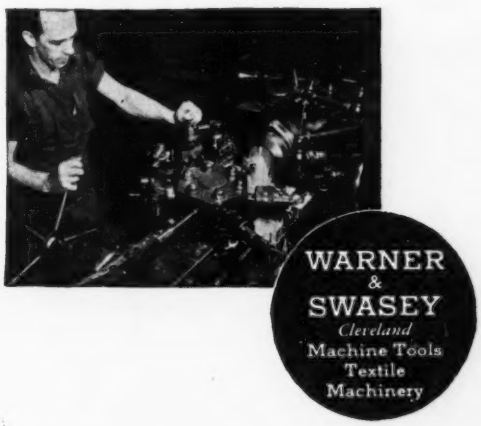
That's the sort of "prosperity" America has been "enjoying."

Most Americans feel they're worth more today than a few years ago; actually their savings have been whittled away 23% in the 7 years since the war. *More money without more goods* always bids prices up and up to the sky.

If you like what's been happening to you, if you think this is prosperity, let's make a *good* job of it; let's make every bill a *million* dollar bill—or a *billion,* as Germany did. If inflated money makes everybody happy, let's be hysterical!

But Germany didn't find it much fun, the morning after.

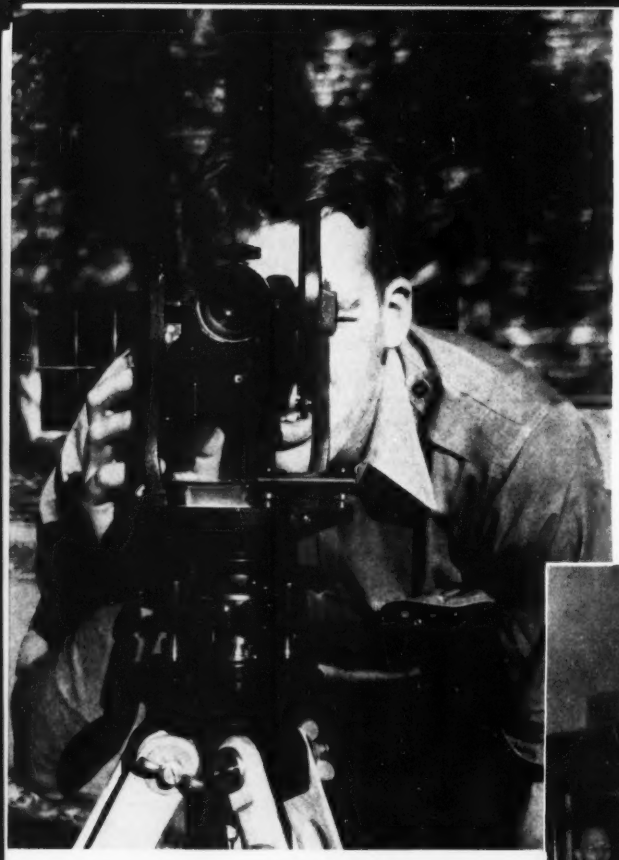
Source: "How to Keep Our Liberty" by Raymond Moley. Published by Knopf, 1952



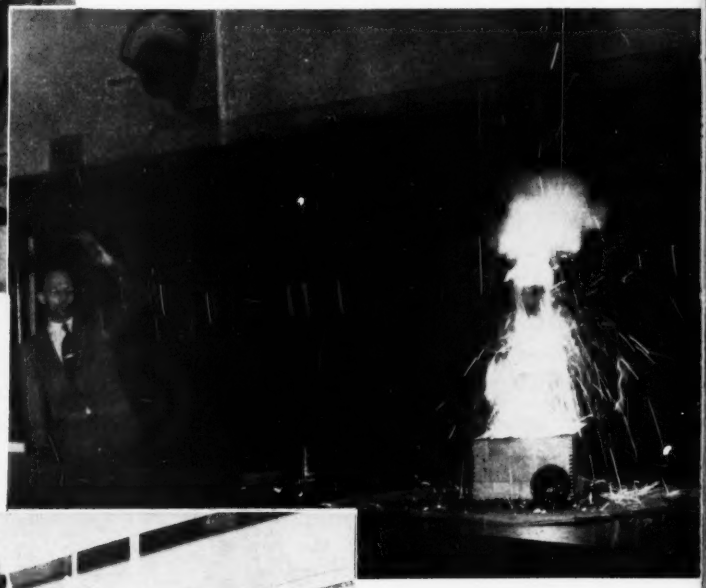
YOU CAN MACHINE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY TURRET LATHES, AUTOMATICS AND TAPPING MACHINES

THE FRESH

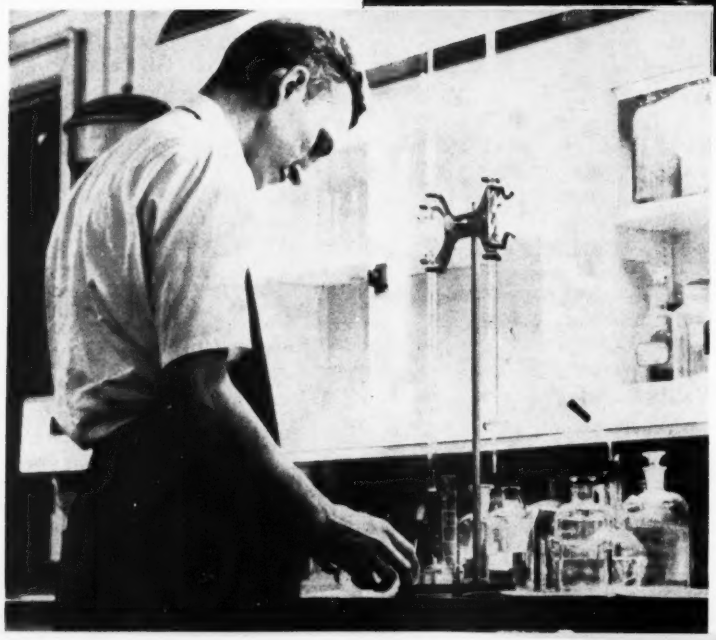
The fundamental aim of the freshman year in engineering is, naturally, to develop the basic theory providing the key to more advanced study. It is here that the embryo engineer begins to acquire the basic tools which will enable to progress further with his education. He gains his first insight into the intricacies of physics, chemistry and higher mathematics, courses which form the solid foundation upon which a modern technical education is built. Work of a more practical nature is encountered too; the freshman is quite soon apt to be found peering through a transit, surveying the Quad or hunched over a lathe in the materials processing lab. He will no doubt be perplexed by the initial difficulties of producing a clean weld and will perhaps stare in dismay at the pile of sand that was once his mold in foundry



1—Above: **A familiar sight on the campus in the fall is that of engineers surveying the quadrangle with their transits.**



2—Right: **Chemistry Professor Van Artsdalen performs an experiment with the firing of iron for a freshman chemistry class.**



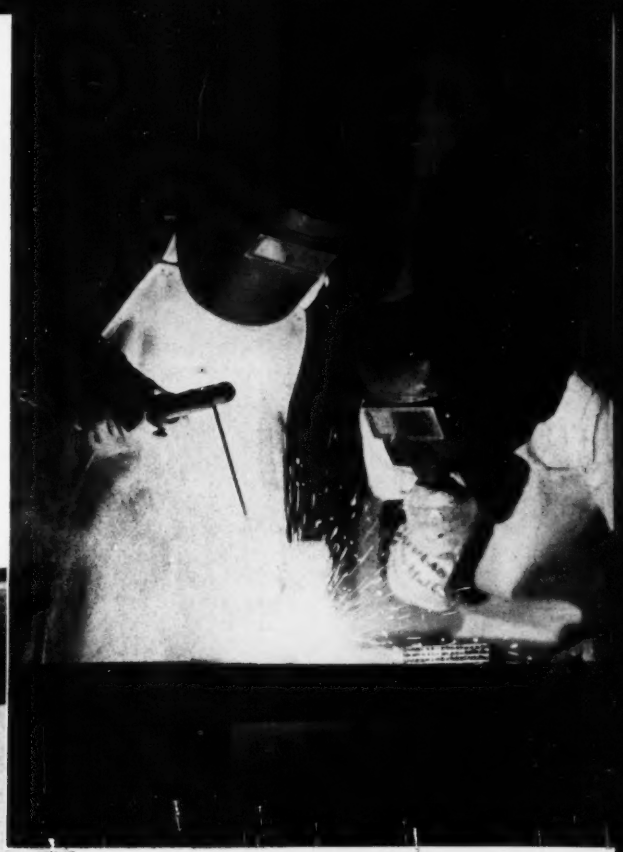
3—Left: **A well known sight to first year engineering students is the chemistry lab. Here a student does a titration experiment.**

MAN YEAR

practice.

Coupled with this technical preparation is the balancing factor of liberal study. These studies, beginning with the first year, are carried throughout the entire period of the student's attendance so that, combined with his experiences and associations in the college community, they form an integral part of his personal culture and a stimulus to further intellectual development.

Herewith we have chosen to present some typical scenes from an engineering student's freshman year at Cornell. Unfortunately, we could not draw a more complete picture within the confines of just two pages; however, we hope that these illustrations will serve to better acquaint freshmen with at least a small part of their forthcoming experiences.

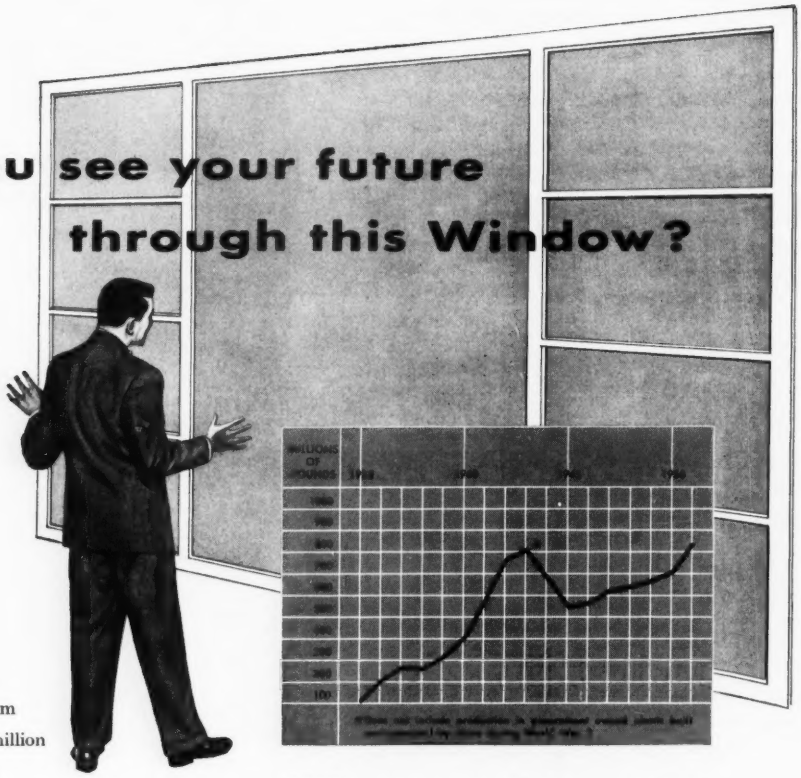


4—Above: **Two students get an opportunity to try their hand at welding in one of the labs of a course in the casting, working, and welding of metals.**

6—Below: **Last, but certainly not least, comes homework. Here is a very common scene, a student "hitting the books".**

5—Above Right: **A familiar sight for first year engineers is that of Physics Professor Grantham demonstrating the principle of the conservation of energy with his hair-raising pendulum experiment.**

Can you see your future through this Window?



This is an aluminum window, one of four million that will go into buildings in 1953. Twenty years ago, it was just an idea in the mind of an Alcoa development engineer. Ten years ago, only a few thousand were made annually. Now, production *is increasing* at the rate of over half a million a year. This is just one of a torrent of new uses for aluminum which means that Alcoa must continue to expand. Consider the opportunities for you if you choose to grow with us.

What can this mean as a career for you?

This is a production chart . . . shows the millions of pounds of aluminum produced by Alcoa each year between 1935 and 1951. Good men did good work to create this record. You can work with these same men, learn from them and qualify yourself for continually developing opportunities. And that production curve—is still rising, we're still expanding, and opportunities for young men joining us now are almost limitless.

Ever-expanding Alcoa needs engineers, metallurgists, and technically minded "laymen" for production, research and sales positions. If you graduate soon, if you want to be with a dynamic company that's "going places", get in touch with us. Benefits are many, stability is a matter of proud record, *opportunities are unlimited.*

For more facts, consult your Placement Director.

The best things in aluminum come first in

ALCOA ALUMINUM

By ALUMINUM COMPANY OF AMERICA · Pittsburgh, Pennsylvania

At this 400-acre "Proving Ground" for Valves

A. E. STALEY Mfg. Co.

consults past performance records . . .
repeats choice of JENKINS VALVES

If you set out to build an industrial "proving ground" for valves, it could include few tougher tests than those imposed in normal services at this 108-building plant for the manufacture of Staley's Corn and Soy Bean Products at Decatur, Illinois.

Processing heavy syrups and concentrates soon seeks out any weak spots in valve design and construction. The punishing work load on valves imposed by tremendous volumes of fluids handled is indicated by the water requirements alone,—over 20,000,000 gallons a day.

Previous experience with the low-cost performance of Jenkins Valves led to their repeated choice for 30 new buildings constructed as part of Staley's multi-million dollar post-war expansion program.

This confidence in the *extra measure* of efficiency and endurance built into Jenkins Valves is shared by plant operating managements in every type of industry.

Despite this extra value, *they pay no more* for Jenkins Valves. For new installations, for all replacements, the Jenkins Diamond is their guide to lasting valve economy. Jenkins Bros., 100 Park Ave., New York 17.

CONTROLLING FLOW from a syrup blending tank (above) requires valves that are "maintenance misers". These are some of the thousands of Jenkins Valves in the Staley plant on water, steam, and processing pipelines, and on compressed air piping serving pneumatic ducts for dry products.

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES

Jenkins Bros

NEWS OF THE COLLEGE

Engineers' Banquet

Disproving the common belief that engineers aren't socially minded, 130 engineering and architecture students and faculty members turned out for the annual Engineers' Honor Banquet Sunday, April 27, at the Clinton House.

President Malott, speaker of the evening, stated that he is interested in engineering because "engineers have acquired a facility in thinking attained in very few other professions." He said further that other schools will follow our lead in the five-year curriculum and that we are quite fortunate to have a school which is both experimental and experienced. The President advised us of the challenge to engineers to continue our education after formal study has ended in order to keep up with today's changing technology.

The various awards were made by the directors of the schools. The ASME award went to Bill Ferguson, M.E. '52, and the ASME awarded a certificate for a fitted bowling ball and case to their retiring adviser, Prof. "Ted" Watson.

In the Civil Engineering School, the ASCE award was given to John Roberts '52. The R. H. Simpson award for best civic design and the Crandall Prize of $75 went to Earl J. Murphy '52. Second, third, and fourth places in the Crandall award for original papers went to Willard Meigs '53, David Hower '52, and Stafford Beach '52, respectively. The Fuertes Scholarship and Medal and the Chi Epsilon chapter award were given to Robert Fitzner '52.

The Chem.E. School awarded a prize to William Johnson, '54, for the best record in his class during the first and second years of college. Benjamin Johnson '52, and John Hinman '52, were recognized for winning second prize in a technical paper competition at Clarkson.

The E.E. scholarship awards were won by Charles Simmons '52, and Peter Pincoffs '52, and the M.E. Sibley prizes for scholarship by Philip Gottling '52, and George Sutton '52. The prize for the best M.E. exhibit for Engineers' Day went to Harold Nelson '52, Ray Erickson '53, and Bob Morlath '52. Robert Katz '52, received an award from the architecture school.

Swatek Wins Fuertes Medal

E. P. Swatek, chief design engineer of The Contracting Division, Dravo Corporation, has been awarded the Fuertes Graduate Medal by Cornell University's

E. P. Swatek

School of Civil Engineering. An alumnus of the class of 1940, he holds the degree of Bachelor of Science in Civil Engineering.

The award was presented to Mr. Swatek in recognition of a paper he prepared on the reconstruction of Lock 2 in the Monongahela River at Braddock, Pa.

Established in 1893, the Fuertes award is given annually to a Cornell graduate who has written the most meritorious paper on some engineering subject tending to advance the scientific and practical interests of the civil engineering profession. Since the award was originated 59 years ago, it has been presented 35 times.

Mr. Swatek received the award during an alumni breakfast at Cornell, on June 7.

Mr. Swatek has been associated with Dravo Corporation since 1940. During World War II, he served as an Ensign with the Navy Sea-Bees. He is a member of the American Society of Civil Engineers and the Engineers Society of Western Pennsylvania.

Faculty Promotions

C. L. Cottrell, electrical engineering, and Dennis G. Shepherd, mechanical engineering, were among the nineteen faculty members promoted to the rank of professor last July. Those advanced to associate professorships included Derald A. Stuart, engineering materials; William McGuire, structural engineering; Harry S. McGaughan, electrical engineering; Thomas J. Baird and Robert H. Siegfried, mechanical engineering.

CE Centennial

Civil engineers of central New York State gathered on the Cornell campus on April 26 to celebrate the 100th anniversary of the founding of the American Society of Civil Engineers, the first national engineering society in the United States.

Hosts were the Ithaca section of the society, including the Binghamton, Elmira and Cortland areas, and the student chapter at Cornell.

Exhibits prepared by civil engineering students for the annual En-

gineers' Day open house were demonstrated to visitors in Lincoln Hall and the Hydraulics Laboratory.

Nine faculty members from the School of Civil Engineering held a panel discussion on the topic "The Next 100 Years," in which they reviewed accomplishments of the civil engineering profession and charted a course for its future service.

Prof. S. C. Hollister, Dean of the College of Engineering and president of the American Society for Engineering Education, spoke at a luncheon meeting of the Ithaca section of ASCE.

The program at Cornell was one of many such celebrations throughout the country this year. A summer long exposition and pageant in Chicago depicting "A Century of Engineering Progress" was climaxed in September by a convocation of thousands of engineers from all over the world.

New Low-Temp Lab

A low-temperature laboratory for research near "absolute zero" is about to go into operation in the Department of Physics at Cornell University.

Under the direction of Prof. Herbert F. Newhall, the facilities will offer another avenue for experiments in the direction of a better understanding of the basic laws of matter.

In addition to the Department of Physics, the Laboratory of Nuclear Studies, Departments of Chemistry and Engineering Physics, and other divisions will have access to the laboratory.

Quarters have been outfitted in the Rockefeller annex and the chief piece of apparatus—a Collins helium cryostat—has been installed. The cryostat provides a ready source of liquefied helium, the most difficult of gasses to liquefy. The resulting temperatures are about 452 degrees below zero Fahrenheit —only 8 degrees away from the theoretically unattainable absolute zero. When exposed to such extreme cold, molecules almost stop moving and scientific measurements can be made which are not possible at ordinary temperatures.

Among the phenomena which the Cornell scientists plan to study are the electronic properties of insulators at extremely low temperatures. Experiments already under way for which the facilities will be used include the "growing" of pure single crystals of important materials.

Prof. Herbert F. Newhall (standing) and Technician John Gilvey draw liquid helium from the Collins helium cryostat after a test in the new low temperature laboratory at Cornell.

Tarboux Leaves Cornell

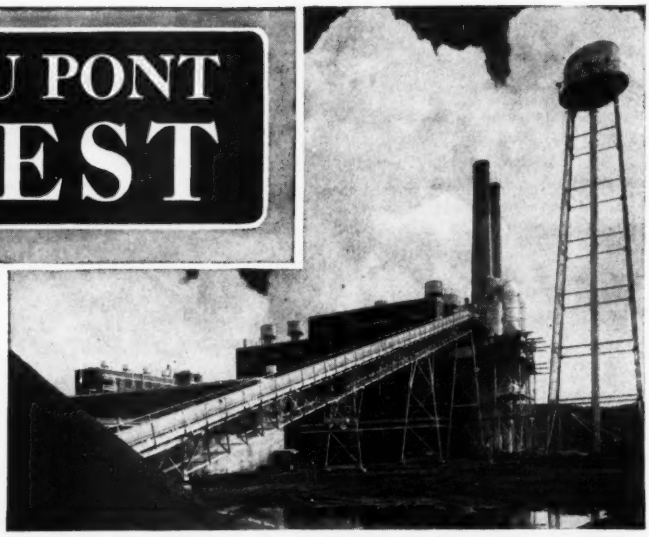
Prof. Joseph G. Tarboux of the School of Electrical Engineering resigned his position at Cornell the beginning of September to assume his duties as professor of electrical engineering at the University of Michigan in Ann Arbor.

Prof. Tarboux first came to Cornell as a student, after receiving his B.S. degrees in M.E. and E.E. at Clemson College in South Carolina. He obtained his E.E., M.E.E., and Ph.D. degrees from Cornell and was advanced to an assistant professorship after six years of instructing in the E.E. school. In 1929 he took charge of the electrical engineering department at the University of Tennessee, where he remained for seventeen years, before coming back to Cornell as a professor.

A quiet, unassuming man, Prof. Tarboux has done a great deal of administrative work as assistant director of the E.E. school and as vice-president of the eastern district of AIEE. His real interest, however, has been in teaching, and when administrative duties became too heavy, he resigned from his post as assistant director a year ago so that he could devote more time to his work. Prof. Tarboux is a member of many honoraries, including Tau Beta Pi and Sigma Xi and is a fellow of AIEE and

(Continued on page 62)

THE DU PONT DIGEST



This powerhouse *for a nylon plant at Martinsville, Va., was designed by Du Pont engineers. It houses two 135,000 lb./hr. boilers and two 7,500 KW extraction turbine generators.*

Power Work for M.E.'s

Varied needs of 71 Du Pont plants pose a host of original power problems

Heart of Du Pont's manufacturing program is the power plant. To make some 1200 products and product lines the Company operates 71 plants.

Most require steam and electric generation, water supply and treatment, heat exchangers, piping systems and related services. The designing of these power plants, their erection and operation are all in the hands of engineers, the great majority being mechanical engineers.

But this is not the most interesting thing about power work here. What challenges the highest skills of the engineer at Du Pont is the wealth of original problems constantly arising. Power requirements vary enormously, not only from plant to plant but from time to time.

Process operating pressures may range from over 15,000 psi. to 2 mm of mercury, electrical requirements from as low as 7,000 to higher than 1 million KWH/day, and temperatures from −360° to over 3,500°F.

George S. Mahaffey, *B.S. in M.E., Penn State '52 (right), B. S. Norling, B.S. in E.E., Washington State '24, and A. S. Noell, Jr., B.S. in E.E., Duke '51, discuss the power requirements of a new processing area.*

Here are examples of recent "off-the-beaten-path" power problems.

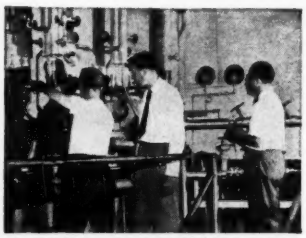
1. A plant using natural gas as its basic fuel produces a waste oil of variable hydrocarbon composition and a waste gas with only 110 Btu/cu. ft. Du Pont M.E.'s designed burners, fans, boilers and combustion controls to permit use of all three fuels for generating steam.

2. At another plant 20,000 gpm of cooling water were to be drawn from a nearby river. Since the water level fluctuated 40 feet between normal and flood stages, it was necessary to evaluate several plans for pump-house constructions against cooling towers. The engineers installed a unique pump house whose submerged vertical pumps operate even when the structure is entirely under water.

Aside from design and construction, Du Pont mechanical engineers concern themselves with such related subjects as economic evaluations, equipment selection, heat balances, load calculations, waste heat boilers.

For example, where various process temperatures from 300° to 600°F. were required, Dowtherm was selected as the supply medium at the rate of 35 million Btu/hr. The engineers installed a central system for primary supply because it calculated to be more economical than separately located vaporizers.

On the operational side, M.E.'s supervise the supply of power and services. They establish performance standards and analyze equipment for results, cost and maintenance.



Edward W. Garrison *(right) M.S. in M.E., California Tech '47, and Byron R. Brown (center), B.S. in M.E., New Hampshire '49, supervise adjustment of furnace conditions in a study of power-plant efficiency.*

Whether viewed from the design and construction side or the operational side, the diversity of Du Pont's manufacture offers a wealth of opportunities in power work for the mechanical engineer.

OPPORTUNITIES for men and women with many types of technical training are discussed fully in "The Du Pont Company and the College Graduate." For a copy, write 2521 Nemours, Wilmington, Del.

DU PONT
REG. U.S. PAT. OFF.

150th Anniversary

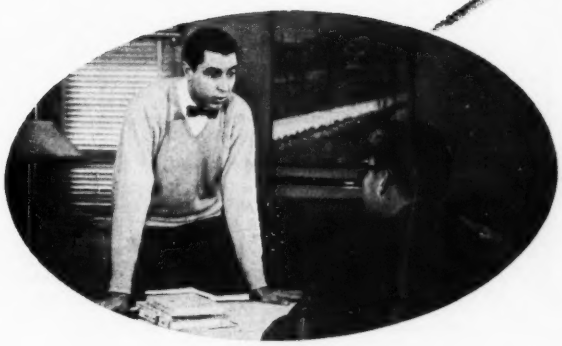
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

Listen to "Cavalcade of America," Tuesday Nights on NBC—See It Every Other Wednesday on NBC TV

ME...
an AIRCRAFT engineer?

But I haven't majored in aeronautical engineering

That doesn't matter. Lockheed can train you... at full pay!



It's your aptitude, your knowledge of engineering principles, your degree in engineering that count.

Those—plus the opportunity Lockheed is offering you—are all you need for a career as an aircraft engineer. In Lockheed's special program for engineering graduates, you may go back to school, or you may convert to aircraft work by doing—on-the-job training. But whichever it is, you receive full pay while learning.

But Lockheed offers you more than a career. It offers you a new life, in an area where living conditions are beyond compare. Outdoor living prevails the year-'round. Mountains, beaches are an hour from Lockheed.

See your Placement Officer today for the details on Lockheed's Aircraft Training Program for engineers, as well as the better living conditions in Southern California.

If your Placement Officer is out of the illustrated brochures describing living and working conditions at Lockheed, write M. V. Mattson, Employment Manager

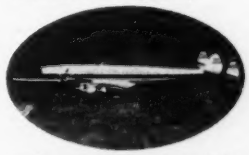
Lockheed Aircraft Corporation

Burbank, California

This Plane made History

The P-38 Lightning – first 400 mile per hour fighter-interceptor, the "fork-tailed Devil" that helped win World War II.

This Plane is making History



The Super Constellation – larger, faster, more powerful; the plane that bridges the gap between modern air transport and commercial jet transport.

This Plane will make History

This plane – which exists only in the brain of an engineer like yourself – is one reason there's a better future for you at Lockheed. For Lockheed will always need engineers with ideas, engineers with imagination, engineers who build the planes that make history.

Draws a line 1/10th
of a mile long with
1 FILLING!
WORLD'S ONLY
DRAWING INK
FOUNTAIN PEN
with interchangeable nibs
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Graphos
Saves thousands of time-wasting pen filling operations for the artist or draftsman—insures uniform thickness of line from hairline to ⅜" thick. Ideal for lettering, freehand drawing, technical drawing, sketching, or stenciling with the interchangeable nibs. Graphos uses any drawing ink, black or colored. Handles exactly like any drawing pen — beautifully balanced, light touch. Time-tested—thousands in use in leading drafting rooms and art studios all over the world. Use the famous PELICAN WATERPROOF DRAWING INKS for best results.
Ask your dealer — or write for illustrated booklets
JOHN HENSCHEL & CO., INC.
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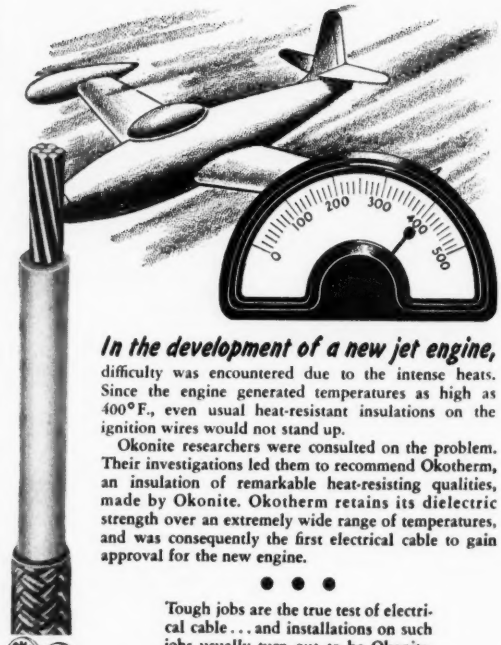


In the development of a new jet engine, difficulty was encountered due to the intense heats. Since the engine generated temperatures as high as 400° F., even usual heat-resistant insulations on the ignition wires would not stand up.

Okonite researchers were consulted on the problem. Their investigations led them to recommend Okotherm, an insulation of remarkable heat-resisting qualities, made by Okonite. Okotherm retains its dielectric strength over an extremely wide range of temperatures, and was consequently the first electrical cable to gain approval for the new engine.

• • •

Tough jobs are the true test of electrical cable . . . and installations on such jobs usually turn out to be Okonite.

OKONITE insulated wires and cables

8799

College News

(*Continued from page 59*)

A.S.M.E.

The professor's work has been concerned with electrical power; he is the author of several books on power systems. At Ann Arbor he hopes to do some development work in power and to set up a strong graduate program.

Engineering Council

The Engineering Council last term undertook a program to coordinate meetings of all school societies by the use of a log book in the Engineer's Lounge and the display of calendars on all school bulletin boards.

In March at a joint meeting of all societies, talks and a movie were given on the Cornell Aeronautical Laboratory. Another joint meeting was held in April at which Dr. Buckley, president of Bell Telephone Laboratories, spoke. The annual Engineers' Day and the well-attended Engineers' Banquet, were held near the end of March.

Council officers for 1952-53 are: Paul Kennard, president; James Villwock, vice-president; William Jewel, secretary-treasurer; with Mr. John McManus as faculty adviser.

Representatives on the council are Paul Kennard, Richard Wambach from the M.E. school; Charles West, Robert Fowler from the E.E. school; Theodore Wong, William Jewel from E.P.; Paul Wisniewski, Thomas Baatz from Met.E.; James Villwock, Robert Stevens from Ch.E.; James Scott, Robert Ready from C.E.; Arthur Mellon from Tau Beta Pi; and David Scheraga from the CORNELL ENGINEER.

A.S.M.E. Activities

The American Society of Mechanical Engineers had many meetings last term; these included a joint meeting with the Cornell Rocket Society for a talk on the Viking rocket, a discussion by fifth-year students of mechanical engineering projects, a meeting with the southern-tier section to hear the society's national president, and the A.S.M.E. student speaking contest.

This term's officers are: Dick Hillsley, chairman; Henry Meurer, vice-chairman; and Bob Olt, secretary.

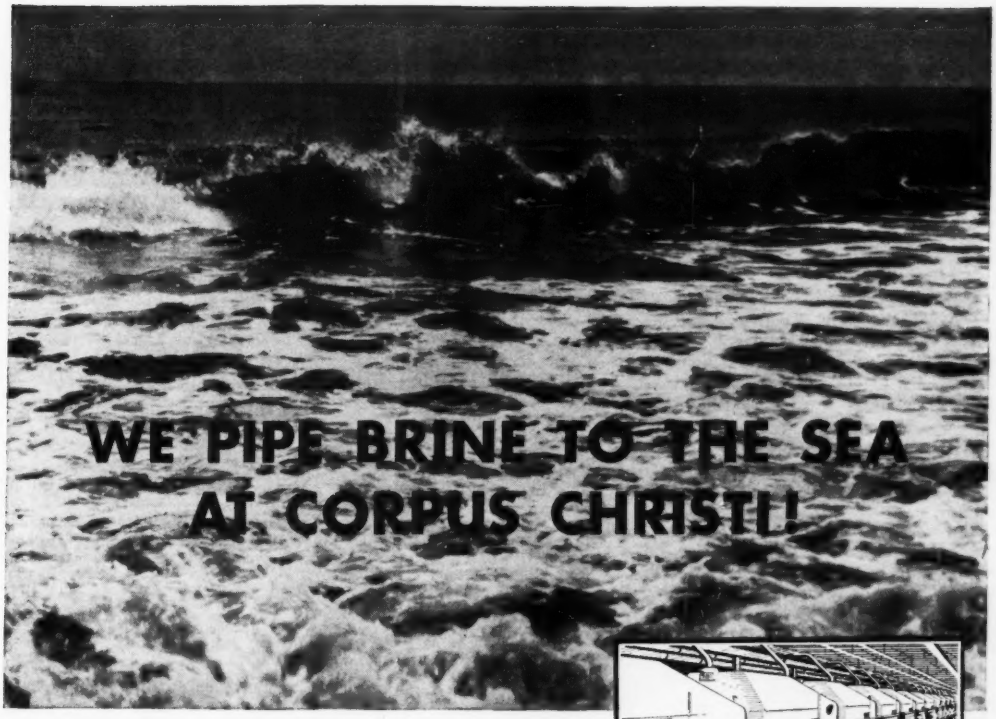
Sigma Xi Elects Sears

The Cornell chapter of Sigma Xi, national honorary science society, last spring elected Prof. William R. Sears, director of the Graduate School of Aeronautical Engineering, as president for 1952-53. Prof. Everett M. Strong of the School of Electrical Engineering was elected to the finance committee for a six-year term.

EE Society Officers

New officers of A.I.E.E. and I.R.E. elected last spring are: Bob Flory, president; Alex Gilmour, vice-president; Adams McAllister, A.I.E.E. secretary; James Shoffner, I.R.E. secretary; and Vic Wintress, treasurer.

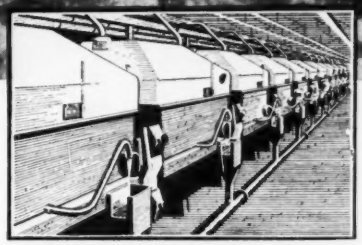
Heading Eta Kappa Nu this year



Although Corpus Christi lies almost at the tip of Texas, on the shore of the salty Gulf of Mexico, Columbia-Southern has brought billions of gallons of brine to its plant there, from the great Palangana salt dome, 60 miles inland. This is less of a paradox than it seems, for with the huge quantities of brine involved in the manufacture of chlorine, caustic soda and other alkalies, it is far more costly to purify and produce saturated saline solutions from sea water on such a scale.

The brine is transported through a 14" pipe line—the nation's longest cast iron line at the time of its construction in 1933. A down-hill flow the entire distance, the capacity is over a million gallons per day—equivalent to more than 125 tank cars of brine, or 30 freight cars handling 2,500,000 pounds of solid salt!

This is one of numerous unique features of Columbia-Southern's Corpus Christi plant—the pioneer alkali operation in the Southwest, and a forerunner of the tremendous chemical expansion in that area. Other Columbia-Southern plants serving industry's needs for alkalies and related chemicals are located at Lake Charles, Louisiana; Barberton, Ohio; Natrium, West Virginia; Bartlett, California.



THE ELECTROLYSIS OF BRINE

Basis of most chlorine production—and therefore a large share of the production of its principal co-product, caustic soda—is the electrolysis of aqueous solutions of sodium chloride.

Using diaphragm cells of ingenious design, the electrical decomposition results in chlorine gas, hydrogen gas and liquid caustic soda.

Chlorine and caustic soda are essential in the processing and production of a multiplicity of products and rank among the most important of all the world's manufactures. Columbia-Southern is one of the major producers of chlorine, caustic soda and other alkalies and related chemicals.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION

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College News

(Continued from page 62)

will be: Don Reynolds, president; Merton Meeker, vice-president; and George Ebel, Dick Bosshard, Tom Duff, and Charles West in other positions.

E.P. Society Events

The Engineering Physics Society last year devoted one meeting to discussion by fifth-year students of summer employment experience at such places as Bell Telephone Laboratories and Oak Ridge National Laboratory.

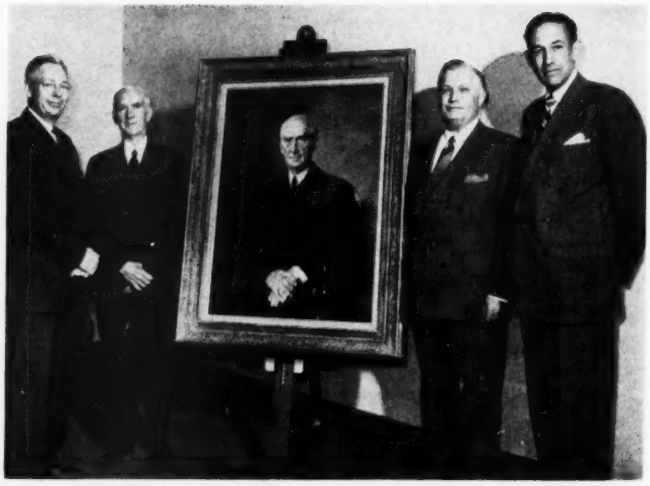
Newly elected to head the organization are: Don Ordway, president; Dave Rossin, vice-president; and Allen Hale, secretary.

Ceremonies At New Labs

Informal cornerstone exercises for the Engineering Materials Laboratories, Kimball and Thurston Halls, were held April 26 at Cornell. Students, faculty and townspeople were present.

President Deane W. Malott presided at the brief ceremonies at the main entrance to the laboratories.

Prof. Dexter S. Kimball, retired dean of the College of Engineering, for whom the Materials Processing Laboratory has been named, spoke briefly and Dean S. C. Hollister presented boxes of engineering memorabilia to members of the Board of Trustees for sealing in the cornerstones.



This portrait of Prof. Dexter S. Kimball, retired dean of the College, was presented to to the university at a reception June 8 in Willard Straight. Shown are Prof. S. C. Hollister, present dean; Professor Kimball; Walker L. Cisler, engineering alumnus and trustee, the donor, and Pres. Deane W. Malott. The portrait will be placed in Kimball Hall.

1952 PUMP ENGINEERING HANDBOOK

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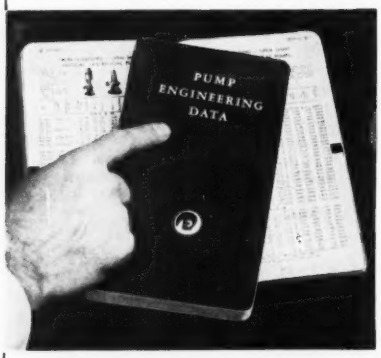

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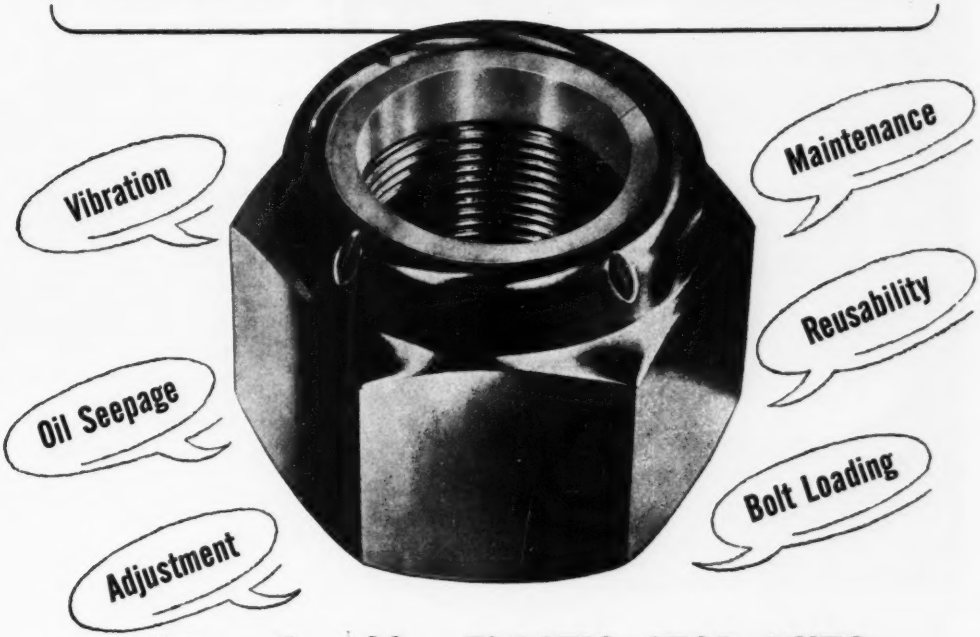

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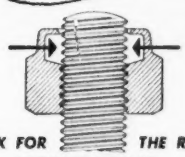

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It is threadless and resilient. Every bolt impresses (but does not cut) its full thread contact in the Red Elastic Collar to fully grip the bolt threads. In addition, this threading action properly seats the metal threads—and eliminates axial play between bolt and nut threads. All Elastic Stop Nuts—regardless of type or size—lock in position anywhere on a bolt or stud, maintain accurate adjustments and seal against liquid seepage. Vibration, impact or stress reversal does not disturb prestressed or positioned settings.

Whenever fastening presents a problem—ESNA is ready with a quick answer. More than 3000 types and sizes of self-locking vibration-proof fasteners—plus the "know-how" of ESNA engineers—are available here at ESNA.

ESNA has long been known as "design headquarters" for self-locking fasteners. Accepted by Army, Navy and Air Force, virtually every aircraft built in the past decade has been Elastic Stop Nut-equipped. On the railroads, in the oil fields, on automobiles and construction equipment, Elastic Stop Nuts manufactured to exacting quality control standards, are doing specialized jobs every day.

Be familiar with the design help ESNA offers. Write us for details on Elastic Stop Nuts. Elastic Stop Nut Corporation of America, 2330 Vauxhall Road, Union, N. J.

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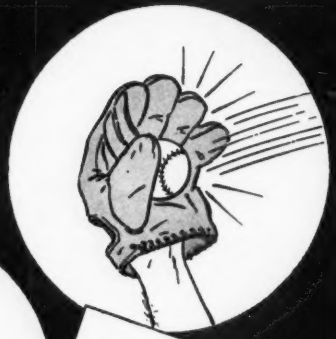
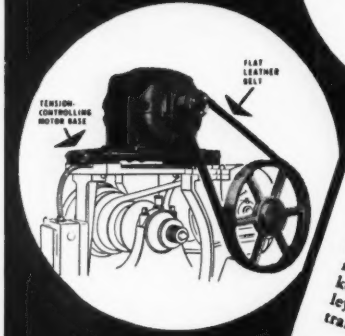
make a good team





In the fielder's glove, a hand controls the tension that makes the leather take hold. In the Uni-Pull drive, a tension-controlling motor base and a modern leather belt team up in practically the same way. The base maintains belt tension . . . keeping leather's high pulley grip at work, effectively transmitting power.

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College News

(Continued from page 64)

Aero Lab Widens Scope

To insure significant attention to industrial research needs, as well as continuing its heavy military research schedule, the Cornell Aeronautical Laboratory of Buffalo last spring established a new Industrial Division.

The move allows more emphasis on the exploration of new fields useful to industry, curtailed previously by a structure intensely devoted to military research and development and directed only at new exploration in military aviation. Over 95 percent of the last fiscal year's research, totaling over four and a half million dollars, was devoted to the defense program.

Industry is now provided with the means to tap the vast reservoir of the accumulated information and techniques from much of the areo laboratory's extensive research. The applications of light-weight materials, substitutes for scarce materials, servo-mechanisms, and guidance devices have considerable interest to industrial clientele, as do studies on electronics, heat transfer, air-flow, and hydraulics.

The Industrial Division is headed by Mr. Edward R. Dye, former head of the Development Division, who is noted for his work in airplane crash safety.

Hollister Awarded D.Sc.

Prof. S. C. Hollister, dean of the College of Engineering at Cornell, was awarded the honorary degree of doctor of science by the University of Wisconsin at commencement exercises there June 20.

Dean Hollister, who took the bachelor of science and civil engineering degrees at Wisconsin, is president of the American Society for Engineering Education, a consultant to the U.S. Maritime Commission, and a member of the Engineering Manpower Commission of the Engineers' Joint Council, the Advisory Committee on Engineering Sciences for Selective Service, and the committee on specialized personnel of the Office of Defense Mobilization.

Takes a lot to lay a carpet in the jungle

The scene is "darkest Africa".

But Africa is lightening. Man's quest for minerals, for new areas for agriculture and trade, is slashing ultra-modern, glaring-white air strips in once impenetrable jungle.

Those pavers, portable air compressors, pumps and air tools—such as you might see working a city street—are Worthington Blue Brutes going to "lay a carpet" in that hole in the jungle.

Thus, Worthington, a major producer of equipment for public works, industry and farm, brings the fruits of American technical genius to the strange places of the world.

And illustrates, too, how the unique American talent of *diversification* helps public, employees and stockholders. For Worthington makes many things—not just construction equipment and pumps, but also engines, water works machinery, power transmission, petroleum equipment, air conditioning and refrigeration, many others.

Such diversification builds *stability* . . . makes Worthington, 112 years old, a strong link in the chain of American business.

Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Harrison, New Jersey.

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Good Water and Sanitation—engines pumps · water treatment · comminutors air compressors · air tools

Lower-Cost Manufacturing—pumps compressors · steam turbines · motors power transmission · air conditioning

Petroleum Products—compressors engines · pumps · chilling equipment refrigeration · decoking systems

More Abundant Food—compressors fertilizer mixers · air conditioning refrigeration · pumps

STRESS and STRAIN...

We've all heard of the sailor who takes a boat ride on his leave, the mailman who takes a walk on his day off, and, of course, you've heard of the college student who spends his summer loafing.

* * *

A furtive young chemist up in Baker Lab dreamed up a serum which would bring inanimate objects to life. He surrepticiously tried it out on the statue of Ezra Cornell on the Quad.

The statute gave a quiver and an instant later, came to life and slipped down from his pedestal. The scientist was overjoyed. "I gave you life, Mr. Cornell," he exulted. "Now tell me, what is the first thing you are going to do with it?"

"That's easy!" rasped the grand old man, ripping an ancient horse pistol from under his frocked coat. "I'm going to shoot about two million pigeons!"

* * *

Report of tardiness to first hour classes: A body in the sack tends to remain in the sack. The cohesive force between the body and sack varies as the square of the time the body is in contact with the sack.

* * *

Papa Robin returned to the nest and proudly announced that he had just made a deposit on a brand new Buick.

* * *

M.E.: Glasses are getting to be a necessity with me.

E.P.: Same here. I can't drink out of a bottle any more without beer dribbling on my chin.

* * *

They were driving in a secluded spot when the car sputtered and stopped.

He: Outa gas, by golly.

Co-ed: Oh, yeah? (Pulls out flask.)

He: Ah ha! And what have we here?

Co-ed: Gasoline.

Five year old: "Daddy, can I have a nickel for an ice cream cone?"

Big "C" Man: "Shut up, and drink your beer."

* * *

Boss: "Who told you that you could neglect your office duties just because I give you a little kiss now and then?"

Secretary: "My attorney."

* * *

I think that I shall never see
A girl who's good enough for me
But that's all right. I've no complaint;
I much prefer the ones who ain't.

* * *

The inspector was extremely annoyed by the amount of noise coming from the adjoining room while he made his usual rounds of the school. Unable to stand it any longer, he opened the door. Seeing one boy taller than the others and talking a great deal, he grabbed him by the collar, dragged him to another room and stood him in the corner.

"Now you stand there and be quiet till I tell you to go back to your room!" the exasperated school inspector commanded.

A quarter-hour later a small head appeared around the door and a small quivering voice asked: "Please, sir, may we have our teacher back now?"

* * *

College men are a lazy lot,
They always take their ease.
Even when they graduate
They do it by degrees.

* * *

Now I lay me down to sleep;
The lecture's dry, the subject's deep.
If he should quit before I wake,
Give me a poke for goodness' sake!

* * *

Use Lumpo. Doesn't lather. Doesn't bubble. Doesn't clean. Just provides company in the tub.

Mrs. Stout: "Do you remember when you were courting me and you carried me in your arms through a puddle? You aren't so gallant as when I was a gal."

Mr. Stout: "But Peggy, you're not so bouyant as when I was a boy."

* * *

Preacher in the pulpit—I have an announcement this morning. If any of you are contemplating matrimony, will you please present yourselves to me after the singing of the hymn, "Mistaken Souls That Dream Of Heaven."

* * *

There was a young lady named
Bright,
Whose speed was much faster than
light.
She set out one day,
In a relative way,
And returned on the previous night.

* * *

Scientists are debating whether or not splitting the atom was a wise crack.

* * *

"Beg pardon, but aren't you a Cornell engineer?"

"No, it's just that I couldn't find my suspenders this morning, my roommate used my last razor blade, all my shirts are at the laundry, and a bus ran over my hat."

* * *

A man went to a physician, complaining about prolonged headaches. The doctor told him to quit smoking.

"I have never used tobacco in any form."

"Well, then, stop drinking."

"I'm a total abstainer."

"Late hours, then, and women."

"I'm always in bed by nine. I am a bachelor and live with two maiden aunts. Now, seriously, what causes my headaches?"

"I don't know," said the puzzled doctor. "Maybe your halo is pinching."

When you design—when you test—when you produce—

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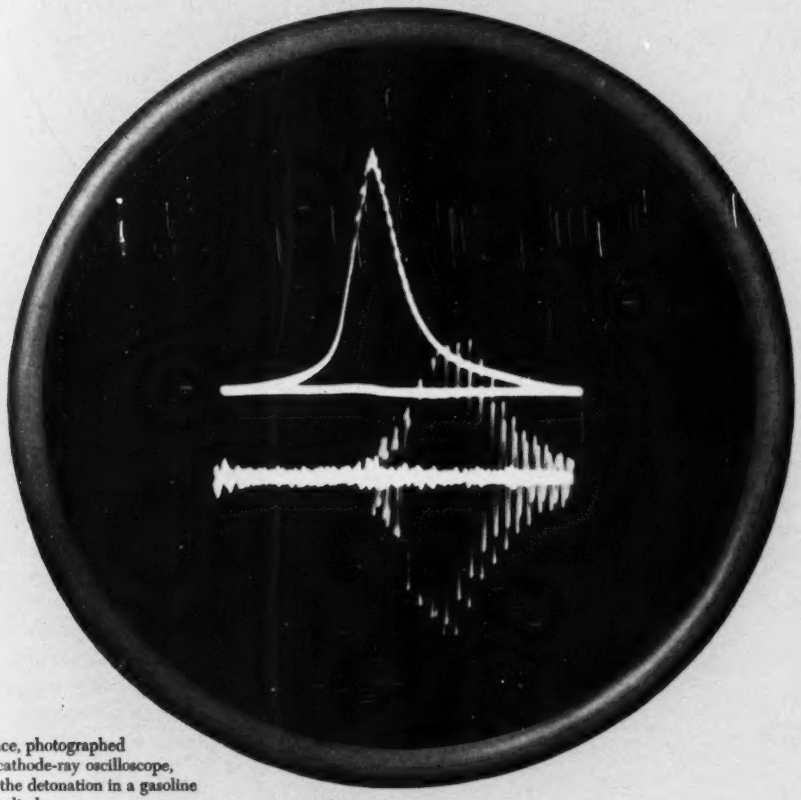
ENGINEERS find good use for photography in virtually everything they do. All kinds of electrical and mechanical operations can be studied through photos of oscillograph traces. Fast-moving parts reveal their behavior in action when high-speed movies stretch a second of motion into 3 or 4 minutes on the screen. Flaws in castings or welds show up in radiographs.

And so it goes. All through engineering, photography has become a constructive and important tool. So important, as a matter of fact, that applying it in its many uses has become a specialty in itself. This has led graduates in the physical sciences and in engineering to find positions with the Eastman Kodak Company.

If you are interested, write to Business and Technical Personnel Department, Eastman Kodak Company, Rochester 4, N. Y.



This trace, photographed from a cathode-ray oscilloscope, depicts the detonation in a gasoline engine cylinder.

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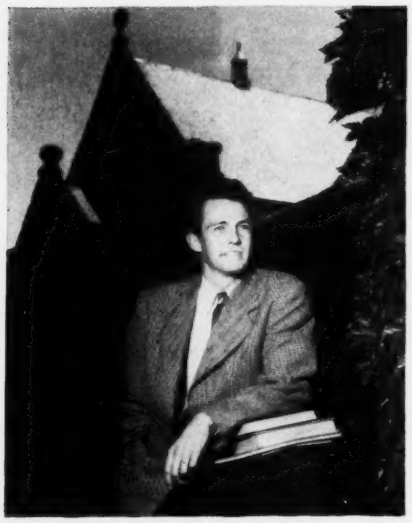

"Can I be sure I'll be an individual at G.E.?"

. . . asks John Dillingham, Union College 1952

What's it like to work for a large company? In this and subsequent ads, the questions of college students on this subject will be answered by G-E men of varying degrees of experience. What's your question? Send it to College Editor, Dept. 221-6, General Electric Co., Schenectady 5, N. Y.

JOHN G. HUTTON, *General Engineering Laboratory* . . . It is largely the enterprise of the individual which makes him outstanding. In his own thinking he becomes a cog in a machine, not realizing that every such cog is a chosen piece, performing functions for what it is best characterized as a vital member of a team operation. So it is with the individual in General Electric. Just as in the community an individual is free to "be himself," but for his own and the community's sake he must be part of that community. General Electric's success lies in its unique ability to instill in its employees great team spirit yet at the same time to recognize the employee's inalienable right to be himself.

H. A. WINNE, *vice-president, Engineering Services* . . . An important point which many young people overlook is that, by and large, individuals work in groups of reasonable size in either large or small companies. In the large company these groups may be called units or sections, and a number of these may constitute a department; a number of departments may make up a division; and the company may comprise several divisions. In each component the "manager" has a comparatively small number of people reporting to him, and consequently any outstanding performer quickly comes to his attention.

Furthermore, in General Electric we have a number of courses which train for advancement and we are constantly combing the organization to recruit people for these courses, so by this separate means management keeps in touch with individuals.

On the basis of forty-two years' experience in the Company I can assure you it is difficult for the college graduate to lose himself in the organization. There are too many people watching him, although he may not realize it for some time after entering the Company.

J. L. MICHAELSON, *manager, Employee Relations, General Engineering Laboratory*...The Company system for periodic employee evaluation furnishes a valuable guide to the individual with respect to his progress and ability. It also imposes on supervisory personnel the requirement that they study carefully the characteristics of all their employees. The system is so arranged that ability and good performance cannot remain unnoticed. Far from remaining obscure, each individual's characteristics are evaluated in order to provide him with the greatest opportunity to make use of his talents and abilities.

J. A. SPENCER, *manager, Employee Relations, Apparatus Sales* . . . The day I began work with G.E. twenty-odd years ago, and entered the plant with thousands of other Company employees, I felt small and insignificant and much inclined to climb on the first train returning to Montana. In a short time, however, I realized that I would be considered as an individual at General Electric.

I learned that the Company was operated in units of manageable size and that each person received individual consideration. My supervisors discussed my progress with me at regular intervals. I also learned that every employee's salary is reviewed individually at regular intervals.

Through this I learned that the individual cannot become lost in General Electric—neither can he hide!

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